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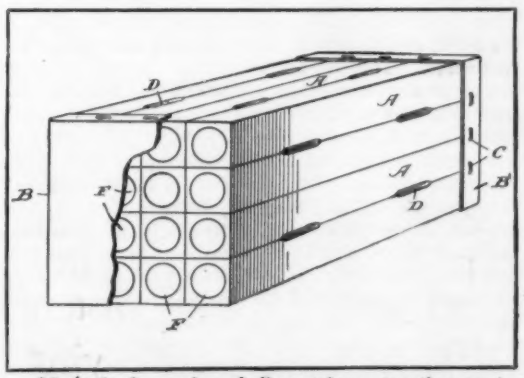
Numerous advantages are gained by providing each shell of small caliber with a recently-invented individual jacket, which protects the shell from the moment it leaves the munition works until it is ready to be placed in the breech of the gun

A Unit System for the Packing and Handling of Artillery Ammunition

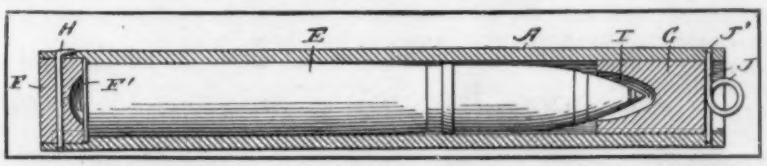
THE usual method of packing small artillery shells for transportation to the field of battle leaves much to be desired at present. It is customary to inclose several, often eight, shells in a heavy iron-bound box of wood, provided with a hinged cover and with heavy internal wood plates to space the shells apart, and with devices for protecting the fuse at one end of the shells. Heavy, occupying far more than twice the space occupied by the shells alone, neither water- nor heat-proof, of no use when emptied at the front and failing to protect satisfactorily the shells during rough handling, the present method exists only because nothing in the way of an improvement has been considered. To extend the fault-finding further, the ammunition box affords no certain means for knowing, without opening the box, whether it contains dead ammunition (shells without the fuse member) or shells ready for use; moreover, when for any reason the box cannot be taken to the battery, the shells when removed are unprotected and invite accidents in handling them and carrying them over rough terrain. Lastly, it is at times necessary for a battery of guns to be moved somewhat precipitately, particularly during an involuntary retreat, and the present heavy boxes are practically immovable under such conditions and must be left behind, sometimes to fall into the hands of the enemy; and even if it is true that the shells can be carried by the men—two or more to each man—they are unwieldy to handle and subject to damage which may render them valueless.

With the foregoing facts in mind, one is better prepared to consider the advantages gained through the use of a novel system of packing and handling artillery ammunition, invented by Joseph A. Steinmetz of Philadelphia, Pa. This system is based on the employment of a distinct case of wood or other suitable material for each shell, and a means for grouping and binding together a number of these shell packages. Thus in the accompanying line



Method of grouping shell-containers together to form a substantial package by means of pressed steel ends

drawings it will be noted that each shell is encased in a square container *A*, preferably of wood or molded incombustible material, internally cylindrical and externally square so that they may be piled to form a symmetrical package of suitable size. Over each end of the shells is placed a closely fitting cap or cup *B* of thin pressed steel or the like, which is secured in place by suitable means; in this particular instance staples, *C*, passing through the cap into the cases, are employed. The cases are cut away as shown at *D* to form hand holds to be engaged by suitable appliances. Each case may contain a closely fitting shell *E* held between blocks *F* and *G* at opposite ends of the case, as shown in the sectional view. The inner face of the block *F* is centrally recessed so that it may not press centrally upon the end of the shell, and the block *G* is similarly provided with a deeper recess to receive and protect the fuse point when "live shells" are shipped. The block *F* is removably held in place by any suitable means, shown in this instance as a sort of cotter pin *H*. The block *G* is held in place by a detachable handle consisting of a coiled wire *J* having aliuing end portions which project into recesses in the walls of the case as shown at *J'* and thus bar the outward movement of the block. The handle may be rotated upon the axis of these end portions so that the loop or coil will lie upon the outer face of the block, out of the way.



Sectional view of an individual container or protective jacket for small-caliber shells

It will be understood that the block *G* is made of such a length that when reversed its non-recessed end face is in position to retain a shell in which the active point is replaced by a screw plug, and that each case having such reversed block will immediately indicate that the shell within cannot bear the active point of a fuse member, since the recess for that member is exposed and can be recognized at a glance or by touch when light is lacking.

The inventor, Mr. Steinmetz, believes that his system meets the present-day call for a cheaper, more compact and safer method of packing and shipping the finished rounds, and that it effectively meets the objections and troubles of the old chest-box. Furthermore, he believes that it offers many features of economy and advantage that are

(Concluded on page 400)

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The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

A Volunteer System Spells Disaster

CONGRESS, following the lead of our President, has responded nobly to his demand that we throw ourselves with our whole forces into the great battle for freedom, justice and humanity. But if recent dispatches from Washington are correct, there is a certain element in Congress which, by settling itself against universal training and advocating in its stead the voluntary system, threatens to strike a blow at our military efficiency which may well lead to disaster at the very first shock of arms.

In his war message and in his policies as subsequently unfolded, the President has shown a broad grasp of the situation and a keen realization of the essentials as distinguished from the non-essentials. Moreover, because he is a profound student of American history and character, he is an earnest advocate of universal service. His attitude has the practically unanimous endorsement of the American people. Those members of Congress who are about to oppose universal training are not only weakening the executive hand in a time of national crisis, but they are running diametrically counter to the spirit and demand of their constituents throughout the country.

For the country has come to realize (the school history notwithstanding) that if there is one military lesson more than another which is written in bold type upon the military records of our Republic, it is this : That humiliation and disaster have invariably followed any attempt to recruit, train and depend upon a voluntary army for the protection of the country. Washington found it so, to his profound humiliation and discouragement, during the war of the Revolution. In the war of 1812, the volunteer army for the defense of Washington broke and fled before a force of Regulars one-half its own strength. History tells us that, when a small force of American Regulars had won a position on the Canadian shore and asked for reinforcements from the volunteer force on the American side of the river, they failed to get them on the ground that these volunteers were enlisted for service only in their native land. Then comes to mind the notorious conduct of the volunteer army in the invasion of Mexico, when our forces, having fought their way to within reach of the Capital, were held up for many long and perilous months because the troops whose period of enlistment had expired, refused to remain and forthwith returned to the United States. And as for the Civil War, we venture the statement that not one of these Congressmen who are opposed to universal training will deny that the prolongation of the war through four long years is to be charged to the defects of the voluntary system.

But let the fathers of the Republic speak to us in their own words: Says Washington: "Experience has shown that a peremptory draft will be the only effectual one. Had we formed a permanent army in the beginning, which by the continuance of men in service had been capable of discipline, we should not have had to retreat with a handful of men across the Delaware in 1776, trembling for the fate of America, which nothing but the infatuation of the enemy could have saved."

Thomas Jefferson, an ardent advocate, if you please, of voluntary service, after seeing its disastrous breakdown in the war of 1812, wrote as follows: "We must train and classify the whole of our male citizenry and make military instruction a regular part of collegiate education. We can never be safe until this is done."

Bull Run should have sounded the death knell of voluntary service. Yet it required one year of war to bring the South to universal service, and it took two years of disaster to bring the North to the same way of thinking.

The arguments in favor of universal military training are so well known that we hesitate to repeat them. To our mind the strongest of all is based upon the fact that everyone who shares in the benefits of our Republic should share also in its perils and responsibilities. Universal freedom and universal protection demand of the citizenry in return universal service.

Putting the poor and the rich under the same tent and giving them such an opportunity to understand each other's problems of life as could be obtained in no other way would make for a true democracy. Ninety per cent of the breach between capital and labor is due to misunderstanding.

Universal training, as proposed in the Chamberlain Bill, would be good economics; for it would take the lad in his nineteenth year, when his earning power is small and before he has married, and make a man of him physically and morally, teaching him to stand, walk, breathe and eat, and filling in that unfathomable void in the average young American's character, to which we refer when we speak of his deplorable lack of a sense of discipline. Finally it would be a deathblow to militarism. A State becomes militaristic when the military and not the civil power has supreme control. But in a free democracy, such as our own, if every soldier were a citizen and a voter, the military and the civil power would become one and the same tning, and militarism, in the very nature of things, would be impossible.

The General Public and the Food Problem

IN entering the war we are assuming far more definitely than ever before the burden of making good the deficit in the French and English food supply. We must, of course, at the same time be fed ourselves. In the face of this prospective demand upon our agricultural resources, greater than any they have ever been called upon to meet, we are confronted with certainty of a farm labor shortage more serious even than that of last year and the year before, and with promise of abnormally meagre response by nature to the farmer's efforts. As never before men will be drawn from the fields into military, naval and manufacturing pursuits; and the crop reports show the poorest outlook in years. The winter wheat acreage is but two per cent above that of last year, the condition on April 1st is 25 per cent below the average for the past ten years, the hold-over of last year's crop is the smallest in many seasons. Wheat is but typical of all crops, and we can look for little assistance from other nations, for conditions in the United States are but fairly representative of conditions everywhere. What are we going to do about it?

Proper agencies of the Government are already hard at work upon comprehensive measures for helping the farmer to help the nation. But this is not sufficient. To be sure, for our supplies of the great staples, wheat and meat, potatoes and milk, we must look almost entirely to the established professional farmer. But we cannot hope suddenly to enlarge the production of this hard-working class in all directions and to the degree that would be necessary to meet the situation. So, without abandoning the effort to get every last calory out of the established farming industry, we must increase the production of foodstuffs elsewhere than on our farms.

This we can fairly hope to do. But it involves that every one of us put his shoulder to the wheel. That class of production which has always been with us, but which has been obtained in haphazard, hit-or-miss fashion, by an infinitesimal fraction of our population, upon absurdly small and widely scattered bits of land, must be extended and speeded up to the last notch if we are to avoid acute discomfort during the coming fall and winter. Like everything else, the agriculture which is a by-product of our time and our land surface must be organized and mobilized. And this must be the contribution of the general public.

It must be clearly understood what this means to each one of us. When the term "general public" is mentioned in connection with an obligation, the individual is all too prone to interpret it as meaning the man in the next house, the next street, the next county, the next state—to accept any alternative, in fact, to the stern reality that it specifically includes *him*. In the present case he must throw overboard this pleasant fiction, and be convinced that the obligation of the general public rests upon every shoulder, and as heavily upon his own as upon that of anybody else. This means that from Eastport to Coronado Beach, and from Key West to Puget Sound every scrap of land which is sufficiently fertile, sufficiently accessible, sufficiently clear and sufficiently free from other useful business must be put under crops of some sort. It means that these crops must be cultivated by labor obtained, not from other fields of useful activity, but from the sum total of our individual leisures. It means that every resident of the United States who, without the most compelling reason, fails to add his quota to our aggregate food production for the coming summer is increasing the misery of the winter to follow, that he is a parasite upon the rest of us, taking from the general store more than he is willing to give in return.

Specific suggestions are not lacking; they are in fact legion, and at an early date many of them will be set forth upon these pages in a special article. It may not be amiss, however, to lay down here a few general principles. In the first place, the general public cannot be expected to compete, and must not expect to compete, with the farmer in the raising of staple crops. Its attention should rather be turned to the smaller items—the various small fruits and vegetables that can most profitably be selected for raising on a small scale. Throughout our rural and semi-rural districts there should be a wholesale conversion of back-yard flower-beds and grass-plots into vegetable gardens. Even the city dweller often has his mite of open space in front or back of his dwelling; and the vacant lots and unused fields surrounding our towns and cities are far from negligible as potential areas of food production. The plan already in effect in certain cities which invites owners of vacant lots to lend them or rent them at nominal sums for garden plots should be nationalized—if necessary, even to the extent of partial remission of taxes on land so employed. We believe that by organized good judgment in the selection of unused tracts for cultivation, the necessity for seriously infringing upon our baseball fields, golf links and other public recreation grounds would be avoided. We must not abandon a due measure of outdoor play.

If substantially everybody does his bit, there will be no labor problem. Every commuter knows that a vegetable garden is not a matter of all-day work, or even of arduous work. We are confident that a very large majority of our non-agricultural population can spare enough time, mornings and evenings, to do effective gardening; can find within reasonable distance of home or business available land, even if only a few square yards; is physically equal to the work, and indeed will be healthier and happier because of it—to say nothing of being wealthier by virtue of its products. Moreover, a very substantial percentage of our families lives under circumstances which make possible the keeping of a few chickens, or perhaps a pig, to be fed largely from the table waste. And the total volume of school-boy and school-girl and boy-scout labor which under good management would be available defies intelligent estimate.

Daylight Saving in Great Britain

A COMMITTEE appointed by the British Home Secretary to inquire into the social and economic results of the Summer Time Act, 1916, has submitted its report, which has been issued as a parliamentary document (Cd. 8487). The report presents quite a body of evidence collected by the committee, and this document, as well as the voluminous reports issued in 1908 and 1909 by a select committee of the House of Commons on what was then called the "daylight saving bill," should be consulted by everybody who is desirous of tracing the history of this interesting reform. The committee finds a great preponderance of public opinion in favor of the new kind of time, and recommends its use every summer hereafter. It is recommended that summer time be in use from the second Sunday in April to the third Sunday in September, the change to be made on the night of Saturday-Sunday in the former case and on the night of Sunday-Monday in the latter. Other countries in Europe where the daylight-saving scheme has been tried are planning to continue it in operation, but there have been various suggestions as to the mode of operation. We note an interesting proposal of M. Lecornu, in a recent number of the *Compte Rendus*, that instead of making an abrupt change in time twice a year, all clocks be run fast so as to gain 30 seconds a day from the winter solstice to the summer solstice, and slow, so as to lose 30 seconds a day, the rest of the year. This would adjust the daily time schedule gradually to the season, and make the time at the summer solstice an hour and a half faster than at the winter solstice.

Chemical Geology

BOTANICAL Geology and Zoological Geology are well-known branches of geologic study, occupying themselves with the fossil remains of earlier forms of life upon our planet. But the chemistry of geology has received far less attention than its importance deserves. Yet its operations, of course, began much earlier than any whose material is organic matter. Pressure and temperature are vital factors in all chemical reactions.

It is obvious that these factors have been undergoing gradual changes during the age-long cooling of the earth; hence the chemical action in the interior of the globe has likewise been profoundly modified. Certain reactions which are dependent on excessively high temperatures would of course cease entirely as the mass cooled and shrank, while others would begin to operate as conditions made them possible. Again, after the appearance of life the domain of chemistry would become infinitely more extensive and complex.

A French scientist, M. Stanislas Meunier, connected with the Museum has recently pointed out in an article published by *L'Actualité Scientifique* [this is presumably published at Paris] that the study of these successive series of chemical phenomena, of their causes and their variations, would probably throw light on many points in the geologic history of our globe which have thus far remained shrouded in obscurity.

Naval and Military

An Army of 1,200,000 Men.—The army estimate of about three billion dollars is for the raising, organizing and equipping of 1,200,000 men made up of a regular Army of 280,000, of National Guard, 440,000 and the first quota of citizen army of 500,000. The National Guard is to be drafted into the regular forces. The President is authorized to call a second quota of 500,000 young men, and thereafter such units for training as will be necessary to keep the other forces at full strength.

One Billion Dollars for the Navy.—The Secretary of the Navy has recently drawn attention to the fact that the navy has on hand for its development about one billion dollars. The estimates submitted, said the Secretary, "cover a personnel of 150,000 for the navy and 30,000 for the marine corps, which are in addition to the 6,000 apprentice seamen, the hospital corps, the enlisted men detailed to the naval militia and the flying corps." The present authorized strength of the navy and marine corps reaches about 97,000 men. The proposed force exceeds this number by 100,000.

Naval Base in the Columbia River.—The Portland *Oregonian* states that the Secretary of the Navy will send to Congress during the present session another report from the commission on the establishment of additional navy yards, recommending the establishment of a submarine and aviation base on the Columbia River near Astoria, Ore., and will recommend an appropriation of $300,000 to acquire a site and prepare the same. This authority states that the commission, in this report, will emphasize the necessity for adequate naval defenses at the mouth of the Columbia River and will favor the acquisition of a site on Cathlamet Bay.

Deepen the Harbors.—The joint Army and Navy Board urges the provision of 40-foot channels for the defense of our ports. The report calls for a channel to the sea 40 feet deep at mean low water for the naval stations at New York, Norfolk, Puget Sound, Hunter's Point, San Francisco and for a 35-foot channel for the stations at Boston, Philadelphia, San Diego and Mare Island. The general board of the navy calls for a minimum depth, as soon as it can be provided, of 35 feet between New York Harbor and Long Island Sound with an ultimate depth of 40 feet. Furthermore, the navy asks for locks at least 1,000 feet long and 110 feet wide, with 40 foot over the sills.

Russian Seaports in the Arctic.—From the beginning of the war, Russia has been suffering from a lack of munitions. The loss of Poland and Galicia were due more to this than to the strength of German arms; and were Russia able, to-day, to arm and equip all the troops which she has with the colors, it is probable that she could drive the Germans out of Poland and the Austrians out of Galicia before the season closed. Much of her shortage is due to the scarcity of seaports through which equipment can be brought in; Vladivostock on the Pacific is her only all-the-year port; for Archangel on the White Sea is available only for five months of the year. But Russia has now available an ice-free port in Kola Fiord at the mouth of the Kola River. Rail connection has been completed to within a few miles of the port and motor truck service established. Kola will go far to solve the munitions problem.

The Terrorizing of the Neutrals.—That the terrorizing of the neutrals by the submarine campaign constitutes the real gravity of the world situation to-day is the belief of the well-known naval critic Archibald Hurd. Given sufficient time, the Germans believe their submarine efforts will be successful; on the other hand, they are well aware that, if Norway and Spain, not to mention Sweden and Holland, determine to declare war on Germany, the conditions of the blockade would be changed at once. Submarines would no longer with impunity be able to slip into or out of the North Sea along Norwegian territorial waters; and the favorable conditions to the south would cease to exist if Spain entered the war. The Allies would then possess both shores of the North Sea entrances, as they would the approaches to the Straits of Gibraltar, and it would then become possible to stop the movements of submarines.

Smoke-Protection Against Submarines.—It is interesting to note how many of the offensive and defensive weapons and appliances that have long been used by warships, are now being applied to merchant ships for defense against submarine piracy. Among others, one calls to mind ramming, the rapid-fire gun, the suggested use of nets suspended from the ship, and lastly, that latest and most effective means of defense, the smoke screen, the apparatus for producing which, has already been installed on many Allied merchant ships. Thus the "Carmania" came into port recently carrying on each side of the after-bridge a large ventilator, through which dense clouds of smoke can be discharged when the weather conditions and the relative positions of the two ships, are favorable. We understand that it is possible for a ship carrying this equipment, to throw out a chemical smoke which is so dense, as to hide her entirely from a pursuing submarine.

Science

Professor Münsterberg's Library.—A number of friends and admirers of the late Prof. Hugo Münsterberg have acquired his library, comprising about 10,000 books, pamphlets and manuscripts, and presented it to Harvard University.

Mineral Resources of the Far East.—The U. S. Bureau of Foreign and Domestic Commerce is sending Mr. J. Morgan Clements, mining engineer and geologist, of New York, on a tour of investigation of the undeveloped mineral fields of the Far East, for the benefit of American capital. An investigation will also be made of the present market in the Far East for mining machinery and equipment.

Wild Life Protection in Canada.—An interdepartmental advisory board, under the chairmanship of Mr. James White, has been appointed by the government of Canada for the purpose of making plans in regard to the protection and utilization of wild animals and wildfowl in the northwestern territories; of advising in the administration of the Northwest Game Act and the laws passed in consequence of the treaty with the United States providing for the protection of migratory birds; and, in general, furnishing advice on the subject of the protection of wild life in Canada.

The Melon Fly, a native of India, was introduced into Hawaii about 1895, probably from Japan, and has proved a serious pest. Some plants of the melon and gourd family can no longer be grown in the islands without protection from this insect, and many other crops have suffered from its depredations. According to the U. S. Department of Agriculture there is great danger that it will be introduced into this country, as shipments of plants and plant products containing specimens of the insect are frequently intercepted at California ports. No satisfactory methods of controlling this pest have yet been discovered.

Potash from Sage Brush.—The Utah Agricultural Experiment Station has been investigating the possibility of obtaining potash in commercial quantities from sage brush and kindred plants growing on the waste lands of the state. Chemical analyses showed that white sage (*Artemisia trifida*), rabbit brush (*Chrysothomus Greenier*) and greasewood (*Sarcobatus vermiculatus*) are especially rich in potash, while the amount of this substance in sage brush (*Artemisia tridentata*) encourage the belief that on non-agricultural lands, where it grows luxuriantly, it might be worth while to burn the sage brush and recover the potash.

Fresh Water Springs in the Ocean.—There are, naturally, many fresh water springs on the bottom of the ocean. Some of those on the coast of France have recently been described by a French writer, who states that certain springs near the shore of the Mediterranean, issuing at a depth of 50 feet, send fresh water to the surface, where fishermen are in the habit of filling their water barrels with it. The island of Moharek of the Bahrein group, in the Persian Gulf, depends upon a submarine spring for its water supply. Divers plunge into the ocean with goatskin bags, which they fill with fresh water and carry to the surface, where the water is poured into casks.

Dr. M. A. Veeder.—In the *Geographical Review* Dr. Ellsworth Huntington pays belated tribute to Dr. M. A. Veeder, who died at Lyons, N. Y., November 16th, 1915. Dr. Veeder attained some prominence a good many years ago as a student of auroras and as the organizer and director of a corps of aurora observers. Dr. Huntington presents a biography and portrait of Dr. Veeder, and one of his hitherto unpublished articles on the relation between solar and terrestrial meteorology. He appears to have been ahead of his time in studies of this character, and unfortunately was hindered by lack of means and leisure from fully developing his hypotheses. Within the field of his profession—medicine—he also displayed the genius of a precursor, for he is said to have been the first to set forth clearly the idea that typhoid germs are carried by flies and he was a pioneer in advocating the open-air treatment of tuberculosis.

Cheap Metal Substitutes.—The recent advance in price of many of the more commonly used metals has led manufacturers to adopt or consider the adoption of various substitute metals or alloys, for certain purposes. The advice of the Bureau of Standards has frequently been sought in this connection. An interesting field of investigation is opened up by such inquiries. It appears that the metals traditionally and currently used for various articles are in many cases no better adapted for the purpose than others, and a slight difference in price would warrant a substitution. It is not usually possible, however, to suggest substitutes offhand, as there are many factors involving manufacturing peculiarities, durability and other physical and chemical properties that first have to be determined. "There is," says the Bureau, "a very wide field of research here, which would undoubtedly repay many fold the efforts put upon it."

Industrial Efficiency

Boxes that Stop Shortage and Theft.—There has lately been introduced on the market a line of wooden boxes which cannot be opened without breaking the wires that seal them. And to break the wires is to leave the tell-tale evidence that cannot be covered. The boxes are normally sealed by twisting the wires tight and cutting them short, and in this manner the condition of the contents as well as the quantity is protected. Furthermore, it is claimed that owing to their peculiar construction these boxes are stronger than others twice their weight.

Diamonds and Accuracy in Machine Work.—Diamonds are sacrificed with a generous hand in the truing up of emery wheels used by a leading automobile manufacturer. It is said that this manufacturer maintains a stock of between 300 and 1,000 uncut stones at all times for the truing of the hundreds of grinding and milling machines in the wet grinding department. The diamonds, which are the only substance hard enough to dress the emery wheels, must be of the best quality, and the stones generally used may be divided into five classifications: Brown borts, gray borts, Jagers-Fontain, Ballas and black carbons.

Misuse of Compressed Air.—Owing to the fact that at least six workers in Pennsylvania have met their death through the misuse of compressed air hose during the present year, the Industrial Board of the Department of Labor and Industry of that State, has passed a ruling that an employee may not even direct the air blast from such a hose on a fellow employee. This ruling makes it a misdemeanor, punishable by fine or imprisonment, for any such violation even though the results may not be serious or fatal. For one reason or another the practical joker about the shop is always bound to make use of a compressed air hose, and as often as not the results of his escapades are fatal.

Increase in Railroad Freight-Carrying Facilities.—Ten years ago the railroads had 1,840,000 freight cars; on December 31st, 1916, the number had grown to 2,518,855, an increase of 678,000 cars. The railroads were not only ordering additional equipment; they were constantly replacing old equipment with new cars of greater carrying capacity than the old. So that while the number of cars in ten years increased 37 per cent, the load-carrying capacity provided by the railroads increased 60 per cent. During this same period the railroads have been adding new tracks, terminals, yards, etc., as well as improving grades and increasing the hauling power of engines. All of this has made it possible to get increased service out of each car.

The Dangers of Trespassing on Railroad Tracks.—A number of leading American railroads are at present conducting a publicity campaign which has for its object the warning of the public not to trespass on railroad tracks. According to a poster issued by the New York, New Haven & Hartford, it is learned that in the years 1912, 1913 and 1914, 442 persons who ventured without authority on the tracks and property of that railroad were killed and 394 injured. In the year 1914 a total of 5,471 lives were lost in this manner on the railroads of the United States. The Pennsylvania system has also issued a poster, the purpose of which is to emphasize the evil of this wilful form of risk which annually, in this country alone, causes over 10,000 casualties—half of them fatal. "You would not willingly expose yourself to disease; so why expose yourself to a peril as great?" ask the railroad companies.

Proper Goggles and the Eyes.—In an article in the *American Machinist* on a new phase of the goggle question, some interesting things are said in regard to eyes and light rays. Occulists tell us that the ultra-violet light ray is the most harmful. A careful study of the ultra-violet light ray and all harmful light in general has been made for the purpose of producing a scientifically correct colored glass for the eye. It is stated that over ninety per cent of the colored glasses in use to-day to protect the eyes from glare are not only inefficient, but are decidedly injurious. The light rays that are so harmful to the eyes are found particularly in the flames and lights used in industrial processes. The oxyacetylene flame is rich in the very harmful ultra-violet ray and the carbon arc even more so. The cobalt-blue glass, which has been used quite largely for protection to the eyes, is found to transmit the harmful rays almost as freely as clear glass, even though the eye may not detect the glare and the operator makes no complaint as to using them. Unfortunately, the eye alone is incapable of selecting the best glass, because the harmful rays are largely invisible and slightly varying colors may be very different in their effect on the eyes. Some idea of the effect of the ultra-violet rays on the eye may be realized when we learn that it is these rays in sunlight which produce sunburn. In a similar way the outer membrane of the eye may be destroyed by the radiation from the quarts mercury arc, the carbon arc or the oxyacetylene flame. Proper colored glasses in goggles will neutralize the most dangerous light rays.

Working in an orchard, where overflow from the river has left a thick deposit of loose, sharp sand

Climbing out of an irrigation ditch—a demonstration of the adaptability of the chain-tread tractor

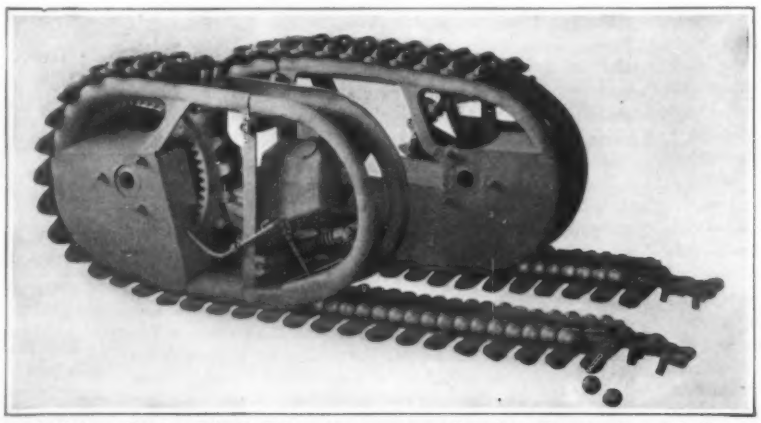
The Ball-Bearing Tractor

Reducing Friction in the Endless Chain Tread

IT was over four years ago that the first attempt was made to apply the principle of the ball bearing to the endless tread of a tractor. The experiment met with the usual criticism that a revolutionary idea seems to arouse. It did not take long, however, to perfect a practical application of this principle and for some three years the ball-tread tractor has been made commercially. The output this last year was four hundred, and six hundred are planned for this year—ample evidence of the practicability of the invention.

We illustrate the tracks of the machines. The one in the foreground is the track for the tractor with twelve horse-power at the drawbar, the other is used on the machine that gives twenty horse-power at the drawbar. A high carbon steel casting is made in two pieces, hinged at the top and telescoped at the bottom. This furnishes a race-way for the balls. The endless chain of manganese links with pressed steel or cast steel shoes in turn rides on the balls. The curvature of the ball race and of angle iron sections riveted to each shoe prevents the balls from coming out and locks the track to the race-way. It is being planned at the present time to manufacture this ball race so that the wearing part is removable. The advantage of a track of this kind consists in reduction of friction. Experiments conducted by the College of Agriculture of the University of California show that the tractor will coast on plowed ground with a 3 per cent grade. To coast on this land it must overcome the friction of both ball treads as well as of two sets of gears in the transmission. Another advantage is that the track cannot be forced off on side-hill work. In fact, this tractor is one of the first machines to make a real success of levee cultivation and work on side-hill vineyards.

The transmission is entirely enclosed, running in oil to keep out the dust. It is equipped with two independent clutches, one for each tread. By virtue of this arrangement it is possible to reverse one tread while the other is going ahead, enabling the machine to pivot around in its own length, just as a man in a row boat can pivot it about its center. The low friction of this machine, its ability to turn in narrow quarters, the traction given by the special shape of the tread shoe—have equipped it to perform many rather unusual feats, some of which we illustrate. These are sufficiently explained by the captions.



Driving wheels of the ball-bearing tractor, stripped to show track and balls

Pulling a disk harrow under trying conditions

Fabric Brake and Clutch Linings in Successful Use

THE extent to which fabric has replaced all other substances as a friction material for brake and clutch linings is hardly realized even by engineers. Mr. J. Oswald, of Glasgow, in a paper read before the Association of Mining Electrical Engineers, dated the use of cotton for this purpose back to 20 years ago, when cotton brake blocks were first tried on horse trams and were found to have points of very great superiority over wood, especially in their efficiency when heated by friction. Since that time great improvements have been made in the manufacture of friction fabrics. The bonding cement has been rendered more heat proof, and a process has been developed by which the burning point of the fabric itself is raised 75 per cent.

Fabric lining is of two principal materials—cotton and asbestos. According to Mr. Oswald the cotton fabric has the highest coefficient of friction—0.5 to 0.7—and is capable of absorbing much greater work in foot-pounds per square inch at a given pressure than asbestos material. The coefficient of friction rises with increased temperature and is practically unaffected by oil and water. In actual test results obtained by the National Physical Laboratory on cotton material, the work absorbed in foot-pounds per square inch per minute was 72,000 dry and 70,000 when lubricated, the pressure being 39 pounds dry and 160 pounds lubricated.

The choice between cotton and asbestos is determined in part by the amount of heat that is likely to be generated. The heat limit with cotton is 400 degrees F., and in all cases where this heat limit is likely to be exceeded it is advisable to adopt asbestos material. The coefficient of friction of this material is 0.3, and it is remarkable that it practically remains constant under varying conditions. Its value lies in its great heat-resisting qualities, which recommend its use on exceptionally heavy and prolonged braking or similar duties. On account of its nature asbestos material is usually reinforced with brass wire, which makes it more expensive than cotton.

Failures with fabric linings are not unknown, but the majority of them Mr. Oswald ascribes to preventable causes: (*a*) To the use of wrong material; (*b*) to failing to keep the fabric face clear of the opposing face when the brakes are out of action; (*c*) failing to insure that the fabric is kept well home when applied, or, in other words, "followed up"; (*d*) incorrect fixing of linings to the engaging media; and (*e*) expecting too much from brakes which have been under dimensioned by the makers for the duties they have to perform.

The immediate reason for introducing fabric linings for the brakes of the underground railways is interesting. Iron brake blocks give off an amount of iron dust which in the aggregate reaches surprising figures. Three-quarters of a ton of brake dust per mile has been proved to be produced every month in the New York subway. This not only short-circuits the electric signalling apparatus and causes the stoppage of trains daily, but as the dust settles on the track the oil from the motors becomes mixed with it and forms a highly inflammable mixture.

An accumulation of the sort mentioned, combined with red-hot sparks from the metal blocks, caused the Paris fire a few years ago, in which 480 persons lost their lives. Fires in London underground railways have also been attributed to this cause. The rapid running of the trains throws off oil from the motors under the coaches, and as the atmosphere is charged with metal dust a very inflammable mixture is scattered all over the train. Partly to prevent these troubles cast-iron blocks were abandoned in favor of cotton linings. Since their introduction not a fire has been reported on any of these railways. Continued use led to the discovery that there was no appreciable wear on the tires, both tires and rails being highly burnished. A further very important result is that since fabric linings have been used rail corrugation and flats in wheels, which existed with the use of metal brake blocks, have disappeared.

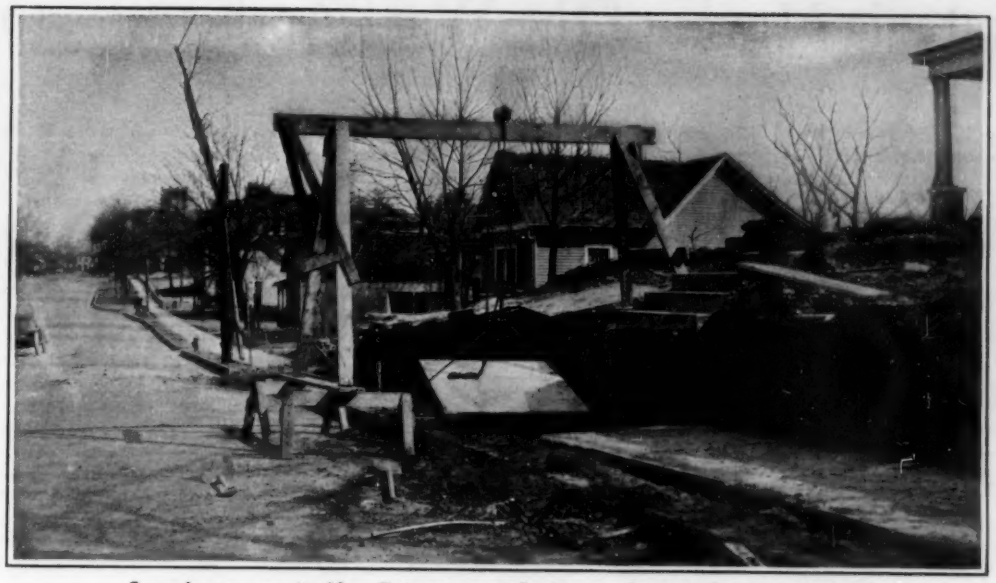
New Way to Tap a Blast Furnace

THE modern blast furnace which in many cases produces as much as 500 to 600 tons of pig iron per day, is often difficult to tap, that is, to open up at the bottom so the melted iron can flow out. The old method, and one still often used, is to drive by force a long pointed bar through the plugged-up hole until the melted iron is reached and then to pull it out, the hot iron following. This often takes a long time and is attended sometimes with many difficulties and dangers.

One of the most modern methods is to use a portable electric drill. Some of the large blast-furnace companies in this country are using this and find it efficient and quick. The drill is allowed to penetrate to within an inch or two of the melted iron, the tapping being completed as usual with a long steel bar. Some five minutes is required for tapping in this way, the actual drilling time being about two minutes.

The drills used are 10 feet long of which about 3 feet are twisted, the diameter of the drill being 2½ inches. The adaptability of such drills to this class of work rests in the fact that they are of sufficient power to drill 2½-inch holes without any chance of stalling. The switch is located at the end of the long handle and the operator, in letting go of the handle, instantly cuts off the power and the drill swings to one side. The illustration shows one of these drills as it appears when used in tapping a blast furnace.

Besides the portable electric drill for this purpose, some plants use the direct electric arc for opening up the hole by intense heat, and others use the oxyacetylene flame in the same way.



Lowering a concrete sidewalk to a new grade, to save the cost of a new pavement

Ship Draftsmen—An Emergency Call

THE need of the Navy Department for ship draftsmen is urgent to the last degree. Millions of dollars are available for new construction and for facilitating work already under way, but all shipbuilding work undertaken at Government yards is retarded by shortage of draftsmen. This shortage is acute, and will be so for some time to come.

In the effort to ameliorate this condition the Government is giving emergency examinations for ship draftsmen (male). These examinations are of the non-assembled type, so that they can be taken in the candidate's home town, and without prejudice to his present employment. Until further notice applications will be received at any time, papers will be examined immediately upon receipt, a grade and rating assigned the competitor, and employment offered at once to those who qualify. The minimum requirements are either (a) graduation from a technical school or college of recognized standing, with one year's experience in shipbuilding; (b) graduation from, or in senior year in, the naval architectural course of a technical school or college of recognized standing; or (c) five years' experience in shipbuilding, three of which must have been spent in the drafting room. First year's pay varies from $3.28 to $6.00 per day, according to the extent to which the candidate exceeds this minimum qualification; and for men who have a year's experience in a supervising ship drafting position the upper limit is even higher.

Candidates should apply at once for Form 1312, stating that they desire to take the examination for ship draftsman (male), and addressing the Civil Service Commission at Washington or the Secretary of the United States Civil Service Board at the Boston, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, Seattle or San Francisco post office or the New York, New Orleans or St. Louis customs house. Every citizen of the United States who is competent to do this work should apply without delay if he would place his services at the disposal of the Government where they will be of the utmost possible value.

New way to tap a blast furnace

Extent of Concrete Roads in the United States

THE great and growing popularity of concrete roads in the United States is indicated by a report of the Portland Cement Association which shows by States the number of square yards of concrete road, street and alley pavements which had been contracted for between January 1st and June 1st, 1916. The total for all the states was 10,247,465 square yards, of which 6,066,205 was roads alone. Illinois leads all the states with a total of 1,855,379 square yards, New York second with 1,185,909 square yards. Indiana was third with Ohio and Iowa following. Alabama, Louisiana, Massachusetts, Montana, Nevada, New Hampshire, New Mexico, North Dakota, Oregon, Rhode Island, Vermont and Wyoming were credited with none of these highways. With a total of 10,000,000 square yards looming up at the time the report was published, indications were that statistics for the entire year would show 1916 to have made a remarkable showing.

Old Sidewalks at New Grades

WHEN the sidewalk grade in Dyersburg, Tenn., was changed, it was necessary either to rebuild a number of perfectly good concrete sidewalks or lower them to the new grade. The latter course was decided upon as being the less expensive, and this opinion was borne out by the ultimate figures. The cost of lowering was 8.8 cents per square foot, while the contract cost of new concrete sidewalk is 12.5 cents, the saving being, therefore, 3.7 cents per square foot. As a special fruit of this work, it may be stated that the contractor has agreed to lower sidewalks in the future for 8 cents per square foot.

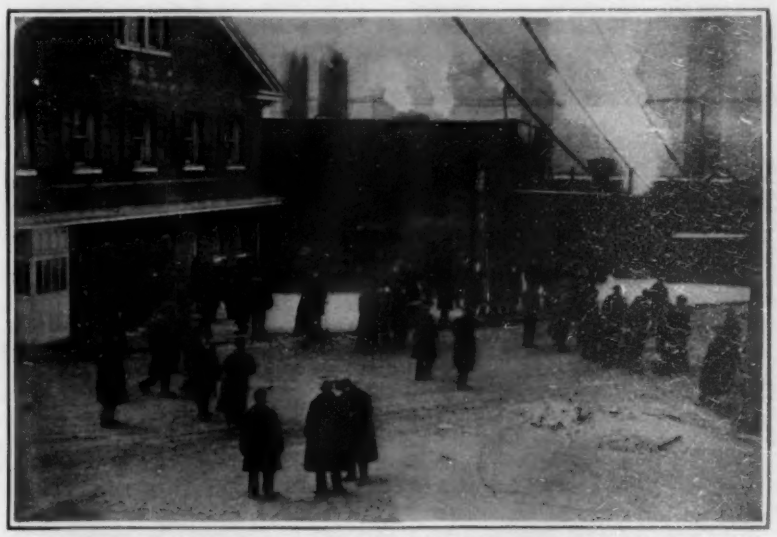
Handling One Hundred Men a Minute at the Time Clock

THE time clock, which has come to be regarded as a symbol of efficiency, is often the means for a considerable loss of time on the part of either the employer or the employee; and this applies particularly to cases where one time clock is used by a large number of men, who, in order to punch their time, must wait their turn on a long line. Thus, this sort of efficiency sometimes militates against itself through the faulty handling of the men; for in the operation of time clocks, as well as in everything else connected with modern business, there is a right way and a wrong way.

An example of the right way to employ time clocks is to be found in the Bush Terminal, New York Harbor, where a system has been installed that permits the handling of over one hundred men a minute. This efficiency is made possible by using four time clocks for about six hundred men, with each clock covering a certain range of numbers. As will be noted in the accompanying illustrations, these clocks are situated near windows in front of which the men line up to punch in or punch out their time; and, contrary to usual practice, the men themselves do not touch the clocks. Instead, one man, who through continual practice becomes quite adept at punching the clocks, punches the clocks as each man files past one of the windows and calls out his number. Naturally, the time clocks are operated one at a time, all the numbers say from 1 to 150 or 200 being handled on the first clock, after which the second clock, with numbers from 150 or 200 to 300 or 400, is operated, and then the next and so on. The numbers covered by each clock are known to the men, who file in front of their respective clocks. Daily, this system handles over 600 men in considerably less than seven minutes.

The accompanying views show the time clocks and a group of laborers on line.

One man, operating four time-clocks, punches the time for six hundred men in less than seven minutes



Laborers at Bush Terminal, awaiting their turn to pass the time-keeper's window in order to ring up their time

Strategic Moves of the War—April 12th, 1917

By Our Military Expert

THE present British operations in France—preceded first by a series of the greatest air combats the world has ever seen and followed by a bombardment that has not been equalled even in this great war—have assumed a scale which, though predicted, has even exceeded all previous anticipations, for their troops have swept forward almost from La Bassée to St. Quentin, on more than a fifty-mile front, and have practically driven a wedge into the German lines five miles beyond Arras. They have continued their advance all the way over the greater part of the 12-mile front from Givenchy to Henin-sur-Cojeul; especially at Monchy-le-Preux, south of the Scarpe River, they are fully five miles within the old German lines, threatening the entire German front along the Arras-Cambrai railroad. In the north the British captured Fampoux and the works defending it on both sides of the Scarpe.

But the most violent fighting thus far reported has taken place around the Vimy Ridge south of Lens, so celebrated in the famous struggles that occurred there in 1915, where after days of fierce battle the Germans retained the commanding positions with the Canadians lower down. The present British sweep east of Arras has therefore turned the northern pivot or wrenched loose the hinges of the famous Hindenburg line; British troops in force are far beyond the limits of the line that the Germans have so carefully prepared for months.

The success has been due to the artillery, which has certainly solved the problem of trench warfare; the long continued hammering from hundreds of guns so thoroughly demoralized the trench defenders that they surrendered by thousands. The great aerial battles last week are now shown to have been undertaken for the purpose of obtaining full information by photographs and otherwise of conditions behind the German lines. Once more the great need of such aerial service is shown; for, if aerial supremacy is once established, an opponent has but little opportunity of carrying out offensive operations with any knowledge of conditions. As the advance now stands, the front runs from La Bassée, almost north of Loos, to the east of and just outside of Lens, just east of the Vimy Ridge that the Canadians now hold throughout, through Farbus, Athies and Monchy-le-Preux and along and around the Scarpe River five miles or more to the south of Arras. Here a junction is made with the northern end of the British advance towards the Arras-Cambrai road, which advance extends in front of Cambrai and St. Quentin; here too it is going forward as rapidly as practicable. From prisoners' statements, the Germans seem to be as much surprised by the far reaching success of the British drive as the British themselves are; the latter by aeroplanes, artillery fire, and the steady push of their men have exceeded all expectations.

The capture of the Vimy Ridge is most notable for it has been a history making battlefield in this war. The country in all directions around is one great graveyard as the French casualties here in 1915 were 100,000 while the British lost 66,000 men in trying to take Lens during the battle of Loos to the north. This ridge has been one of the boasted German field fortresses; dominating as it did, by its elevation of four hundred to five hundred feet, the surrounding country, it was truly a strategic position; with the ridge firmly held, the Germans could swing slowly back in almost any direction, thus covering the rich French industrial districts upon which they depended so much for supplies. But with the ridge captured, the defense of the districts cannot be carried out, the pivot of the Hindenburg retirement again shifts and the latter's line is in danger of being broken.

From what has been accomplished so far there seems to be one thing that is inevitable, the early evacuation of Lens and the abandonment of the present lines by the Germans as far north as La Bassée and more than probably as far north as Armentières. With the loss of Lens the Germans will also lose the French coal districts and will have the first loss of this kind in their withdrawal. Since the British hold the high ground at Monchy and also the Vimy Ridge to the north, they practically command all ground almost up to Douai, over an extended front. With heavy guns on the Vimy Ridge, Vimy itself must fall and the abandonment of many square miles of territory must follow with a rapid retreat to some new line on this part of defense, possibly one from Lille to Cambrai passing in front of Douai that has already been prepared for just such a contingency—this line to be held for a further retirement to the new natural position La Bassée or Armentières-Lille-Valenciennes-Hirson or Mézières.

If the British finally succeed in breaking through the German lines at Arras and to the north, the line to the south that has been drawing back and is now halting in front of Cambrai and St. Quentin on the supposed Hindenburg line will have been outflanked and must retreat. The present situation is somewhat obscure as just now the British are securing their present advantages; and, until the German withdrawal passes the Lille-Cambrai-St. Quentin line, all that can be said is that the Germans have been shortening their front. Once that line is forced, the result of the spring operations on this front so far can be termed a German disaster.

At last it can be said, the British army has found itself—the little army that was so looked down upon when the war began has now grown to more than man size. The British soldier has proved himself the equal, if not the superior of the German. This army is a danger and a very serious one to German supremacy—a fact now more than ever realized by German commanders. It is an accomplishment by England, never deemed possible by German officers.

Violent artillery fire on the French front extending from St. Quentin past Rheims into the Champagne country is reported; it seems evident that an offensive by the Entente Allies on a large scale in this region may be expected at any time.

On the eastern front the Russians claim to have checked a German advance southwest of Riga, while they have been forced to yield a bridgehead and crossing of the Stokhod River about thirty-five miles northeast of Kovel. The Germans claim to have captured here

The British advance about Arras, up to April 12th

about nine thousand men and a number of guns. Nothing of importance except artillery duels has occurred on the other fronts.

Italy, however, is at present greatly disturbed in view of the reported assembling in the Trentino by Austria of a large force, given as possibly one million of men, for the invasion of that country. Whether this force will advance east of Lake Garda upon Verona and Mantua or west of the same lake into Lombardy with Brescia as its objective, has not yet been determined. The ultimate object in either case will be the cutting off of the line of supplies of the Isonzo-Carso front. Last year the object was the same only the advance was made much farther east along Arsiero and Asiago; the Austrians were not quick enough and they were driven back with the loss of nearly all the territory occupied by them. A glance at the map of the areas of war on this front will show that, if the Italian sources of supply are once cut off, all the troops on the Isonzo front would be isolated and forced to surrender. The advance of the Italian forces here with the capture of Gorizia has proved a serious menace to Trieste, a port essential to Austrian trade and commerce.

What has been so often predicted as likely to occur in Mesopotamia came to pass early in the present month when a telegram from London dated April 5th reported the junction of the British troops with the Russians coming from Persia, at Kizelrobat on the direct road from Khanikin to Bagdad. The point of meeting is about eighty miles northeast of Bagdad and only a short distance from the Persian border. The Diala River at this point flows nearly parallel with the border from northeast to southwest, emptying into the Tigris just below Bagdad. Khanikin itself is on or very close to the Persian-Turkish frontier, about ninety miles northeast of Bagdad and on the present caravan road from that city into Persia. The report of the junction of the columns of troops shows that the Turks have been entirely driven out of southern and western Persia; the latest information reports their defeat at Dekke on the Diala and their retreat to the town of Kifri west of that river in the highlands of the vilayet of Mosul and about thirty miles northwest of Khanikin.

The junction of the Russian and British forces, viewed in both a tactical and a strategical light, marks a most successful coördination in the combined military operations of the two columns. At the time of the British success at Kut-el-Amara the Russians were at or near Hamadan, about two hundred and fifty miles from Khanikin; they immediately took advantage of the Turkish defeat on the Tigris and moved forward through Kermanshah and Kerind to Khanikin, a six week's march and a most remarkable one when the mountainous, barren, and unsettled nature of the country passed through is considered. Another column of Russian troops is coming southwest from Lake Urumiah and Baneh, moving on Mosul. As the combined British-Russian troops in the south are forcing the Turks northward toward Mosul it looks as if the entire Turkish army operating in eastern Mesopotamia will be captured at an early date by being taken as in a trap between the two hostile forces. This is the more probable as they have already lost so heavily in guns, equipment and supplies.

The latest reports show that the British forces are now more than fifty miles north of Bagdad on the Bagdad-Samara-Tekrit railroad and have captured the Balad railway station. The Russians acting in concert from Kizil Robat have already begun operations to cut the Turkish communications. Meanwhile, the Turks seem to be endeavoring to put a wedge between the two columns by a converging movement on the British lines between the Diala and Adhem Rivers and were in contact with British patrols at Garfah and Deli Abbas between the two rivers. There seems, however, but little prospect of any marked Turkish success there in view of the apparently demoralized condition of their forces.

The longest front on any of theaters of war is now established here in Asia; the line begins at the advanced Russian position on the Black Sea west of Trebizond, thence to the west of Erzerum and Lake Van to the Persian frontier and down the Tigris to the Persian Gulf; a distance of thirteen hundred miles or more. The Russian troops in Armenia have heretofore been supplied over mountain roads from Kars and Erivan in Georgia; now such supplies can be brought through the Persian Gulf and up the Tigris River. Such an arrangement places military operations upon an entirely different basis and it would seem certain that all the Turkish troops that have been operating in the area between Mosul and Tekrit on the Tigris and Khanikin and Urumiah on the borders of Persia must soon surrender.

After that happens the campaign can be conducted along well defined limits and over well travelled routes. A glance at any good map of this region will show the routes that would naturally be followed, if necessary. From Bagdad in a northwesterly direction there is a caravan route that goes up the Euphrates to Aleppo, 500 miles away. Near Aleppo the Bagdad railway forms a junction with the Damascus-Medina-Mecca line that runs south some fifty miles east of the present positions of the British forces operating around Hebron, Gaza and along the Mediterranean shores threatening Jerusalem. If Mosul is once captured, there is another route to Aleppo along the Bagdad railway which is reported completed from Aleppo to Nisibin, 230 miles east, and partly constructed from that place to Mosul. The Russian armies in Armenia have several routes of advances that can be used, as may be desired. One route would be from Van or Bitlis or both down the Tigris to Mosul joining the British-Russian forces there. Another route would be from Erzingan, Kharput or Diarbekir to the crossing of the Euphrates River by the Bagdad railway at Jerablu about one hundred miles east of Aleppo. A third route would be a direct advance from Erzerum through Erzingan against the Turkish front that extends from Alexandretta on the Mediterranean to Samsoun on the Black Sea. This front is fortified at the best strategic points along the line of 300 miles between the places mentioned. The northern part of the line is supplied from Constantinople by sea, when the Russian fleet permits, but generally from Angora, the terminus of the railroad from Constantinople

(*Concluded on page 406*)

Recent Chemical Developments

Starch as a Substitute for Glycerine and Cotton in Explosives

By Ellwood Hendrick

IN some respects American industry has led the world, and in other respects it has not. In the organization of large units of production, in the preparation of containers, in the line-up of raw materials and the domestic sale of finished products, as well as in cost accounting and labor-saving, the American manufacturer has done well. His weakness has been in regard to what goes on inside of his pots and kettles. In treating metals he has gone ahead by leaps and bounds, and the reason why this has been possible is because, beginning with Andrew Carnegie and the Pittsburgh ironmasters, the chemist has been called in. The chemist has also been welcomed in the petroleum industry, in the making of explosives and latterly in the distillation and manufacture of products from coal tar, and in a whole series of other fields which have been successfully cultivated.

In other fields the chemist has not been wanted; the dread of the theorist has kept the doors of certain industries closed to him—or nearly closed—and waste and loss continue in spite, as the greatest offenders are likely to say, of all that mortal man can do. We shall not sit in judgment at this time and say where blame rests. It is seldom indeed that a man is enlightened by being told that he is wrong. The normal answer to such a charge is a general denial, and the accused straightway proceeds to engage intensively in efforts to justify himself. Then, too, it might just as well be said that the writer of this doesn't know everything about chemistry or anything else, and that sometimes he guesses wrong.

All we propose to do is to give notes and comments on chemical progress of one sort or another without any particular connection of subjects. We shall try to make it as though we were sitting together in a ring and you were to say, "What's going on in chemistry?" and then I should answer with a little more time to think it over than if it were said off-hand. And yet it will be pretty much off-hand stuff. Some of it may interest you, some of it may not, some of it may be useful to you and some of it may come in handy later.

To begin with, let us consider a tendency, and that is the use of germs, of yeast plants and bacilli, in chemical industry. In making alcohol and vinegar the art is as old as Noah, but that is a mere fraction of the field. The chemist is cultivating the microbe to make it do his work for him. And he is finding the microbe more and more useful in different processes. Once he knows the right bacillus and its ways, it is much simpler to put some of the proper culture into a vat, cover it up and leave it, than to worry over apparatus and temperatures and pressures and agitation and any number of other problems. This is the work of the biological chemist and he is coming into industry. We shall discuss the subject at length some other time.

Mr. S. S. Sadtler of Philadelphia belongs to a chemical family and he is known to the general public by his excellent book "Chemistry of Familiar Things." In the current number of *Metallurgical and Chemical Engineering* he publishes an interesting article on "Nitro-Starch as an Explosive." Before quoting from it, however, it may be worth while to consider the chemical cousinship in which starch is involved. There is a sweet and sticky body called glycerine. Similar but longer carbon chains with hydrogen and oxygen atoms attached to them are known as sugars, of which there are many kinds. They are also sweet and sticky. Now nature has a way of bunching these sugar molecules or sugar units together until they produce other bodies, composed of the same elements but differing in their structure, just as we can move together a number of houses built of the same kind of materials so that they become one connected house. By this bunching, or polymerization as it is known in the clumsy language of chemistry, the sugars become gums. Nature does so some more and the product is starch and it does so still more and the product is cellulose. Cellulose is the fiber of which vegetable cells are made. Cotton is nearly pure cellulose.

Observe, please, that this carbohydrate family which begins with alcohols, includes glycerine and its close relatives, and goes on to include sugars, gums, starches and cellulose, all made of the same three elements, carbon, hydrogen and oxygen.

Now let us get to work with nitric acid and add a nitric acid tail to the glycerine. Then let us go further and add a second and a third nitric acid tail to it so that we have tri-nitro-glycerine. That is the explosive nitroglycerine. T. N. T. is tri-nitro-toluene. Those nitric acid tails are the business end of a good many explosives. Sugars do not seem to be robust enough to stand this and starch has heretofore been impermanent when nitrified. But cellulose is easily nitrified, just as glycerine is, and the result is gun cotton. If we could nitrify starch it would be a desirable thing because, to quote from Mr. Sadtler's article, the commercial use of high explosives in the United States which was 30,626,000 pounds in 1890 had grown to 244,151,000 pounds in 1915. This is commercial use, and includes the increasing requirement of farmers in land tillage, tree-planting and a wide range of uses. Man-killing is merely an incidental use of them.

The price of glycerine has gone soaring and nobody but a bull cotton speculator says that cotton is cheap. But starch at 2½ or 3 cents a pound, or even 3½ cents a pound (which is dear), sounds cheap enough compared with 55 cents a pound for glycerine and 20 cents for cotton. The problem of producing a permanent nitro-starch and a suitable container for the use of nitro-starch explosives has now, says Mr. Sadtler, been solved. This is important, because the successful manufacture of nitro-starch explosives means a great deal for agriculture, mining and engineering undertakings.

Nitro-starch is insoluble in water but may be dissolved in acetone and other well-known solvents. As with gun cotton, the appearance of the starch is not changed except that the grains are somewhat swollen. It is, however, much denser than gun cotton (or nitro-cellulose) and occupies only about one-fifth of the volume of the latter, although when it is dissolved and the solvent is evaporated both nitro-starch and nitro-cellulose have about the same bulk.

The original dynamite of Alfred Nobel was nitroglycerine mechanically absorbed in kieselguhr or diatonaceous earth. There are, however, a number of mixtures of nitroglycerine with gun-cotton dissolved in it and mixed with sawdust, mica and any number of other ingredients to meet special conditions, so that the term dynamite has become more general than specific. But by working in 80 to 85 per cent of nitro-starch

(Concluded on page 403)

The Value of Agriculture in Time of War

By E. M. K. Geiling

THE great conflict now raging in Europe has very clearly and emphatically brought out the real importance of agriculture and agricultural institutions to a nation. "The problem of maintaining, and in some cases increasing, the production of food for man and beast has been one of the large and difficult ones in the countries at war. It has taxed their skill and organization, and their ability in the common good. With thousands of acres devastated, relations with other countries interrupted, and with a vast army of farmers and laborers on whom production ordinarily rests, suddenly become dependent on the labor of others, the necessity of cultivating all available land and making the soil yield its full return became a national concern in all countries."

Science played an especially important rôle in meeting these emergencies. Economists, sociologists, agriculturists, dietitians, etc., all coöperated in effecting economies, growing suitable crops, testing new food materials, and above all, in utilizing waste products. It is especially in this latter phase that the scientists in some of the different belligerent countries have been most active.

The first efforts in the various countries centered largely on providing the harvesting machinery for gathering in and saving the crops. In this work the military authorities gave much assistance. Later on, when the supplies were diminishing, the need for more intense cultivation became apparent.

The French Minister of Agriculture issued orders to district commanders to assign soldiers for agricultural duties. He said: "The regular and (as far as possible) complete execution of agricultural work constitutes one of the principal forces of success. The full use of the soil must be maintained at all costs."

In Great Britain steps were early taken to organize the agricultural forces and to increase the food production. England, on account of her supremacy at sea, is able to secure food from the neutral nations. However, the President of the Board of Agriculture in England said that "if agriculture had made no more progress in Germany than it has in the United Kingdom during the period 1895-1915, the German Empire would have been at the end of its resources long before the second year of the war." He explained further that the war was being fought by Germany quite as much on an agricultural, as on a military, organization of the nation.

Many committees and societies have been formed in Great Britain for the assistance of farmers. Land not ordinarily employed in agriculture is being utilized. Private parks, golf links and pleasure grounds are being plowed up and seeded. In Germany the urgent need for the greatest possible production of food was urged on the people, since the outside sources of supply had been cut off. Systematic provision has been made for the cultivation of the land, and the most needed crops are being extensively grown.

The foregoing will suffice, in a general way, to show the realization of the importance of agriculture by the belligerents. Taking up in more detail the specific economies practiced by the different warring nations, it appears that Germany has done more than any of her enemies in making use of waste products and in adapting the nation to the newly created situation.

At the outbreak of the great war Germany was forced to make the question of the food supply a national one. Many of the eminent scientists were called into consultation to devise means of securing food for the nation, as the imports from oversea had been restricted. Meat, butter, cheese and fish formerly obtained from Holland and Denmark were no longer available. To increase the production of food and diminish the waste, the scientists recommended increasing the crop of beans with its high protein content, reducing the unnecessarily large meat supply and increasing the intake of cheese and skim milk, improving the yield of vegetables and fruits, and reducing the quantity of butter and cream. It was estimated that these recommendations would furnish 26 per cent more food than is required for the maintenance of the nation. There can be no doubt that respect for the scientific knowledge of specialists was of highest value in the hour of national exigency. "Countries in which highly educated men are slightly esteemed would have passed over this advice, would have consigned it to the newspaper dunghill of highbrow information, and starved to death in consequence."

In addition the following interesting facts may be mentioned: The question of a suitable war bread has received considerable attention in Germany. In order to increase the protein content, blood and nutritive yeast have been added. The blood is treated in such a way as to lose its unpleasant color and adds an agreeable flavor to the bread. Various strains of yeast have been cultivated—one rich in fact, the other high in protein. The yeast may be eaten dry with salt, or, if mixed with potato flour and hot water, it makes a nourishing and palatable soup. Potatoes are grown extensively in Germany and the starch therefrom has been used in the making of "war bread". (Incidentally it may be mentioned that in a recent article in *The Country Gentleman* the use of barley in making bread is urged, on account of the phenomenally high price of wheat.

Many other economies have been practised, such as apportioning food in grams and increasing the number of lunches in schools—the number rose from 150,000 to 500,000 in one of the large centers. The plan is to give the children 40 to 50 per cent of the day's ration at school.

When straw is treated with 2 to 4 per cent sodium hydroxide and then washed, the crude fiber is rendered digestible with scarcely any residue. One kilo of straw thus treated, mixed with 20 per cent molasses furnished as much energy as 2.55 kilos of hay or .92 kilos oats.

It is reported that materials containing cellulose, especially wood of all kinds, when treated with acids and alkalies under heat and pressure, are converted into fodder which, when mixed with brewers' husks, is taken by farm animals with relish. The wood is first subjected to distillation to recover the wood spirits, the residue is then worked up as mentioned above for fodder.

Bayer & Co., one of the big German chemistry trusts, report the manufacture of a fodder from the residue left after the alcoholic fermentation of corn. After fermentation the alcohol and acetone are distilled off, the residue is compressed into cakes and forms a good cattle food. Also, protein forage is reported to have been artificially manufactured in Germany. Ammonium sulfate, sugar and a certain strain of yeast are mixed,

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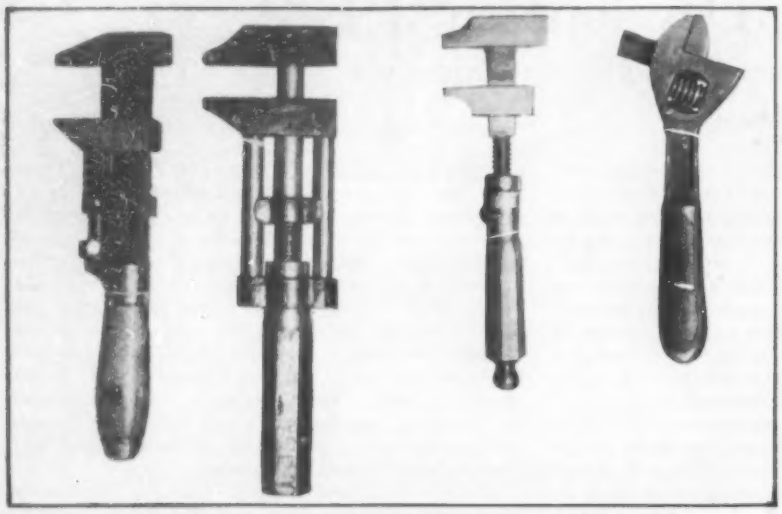
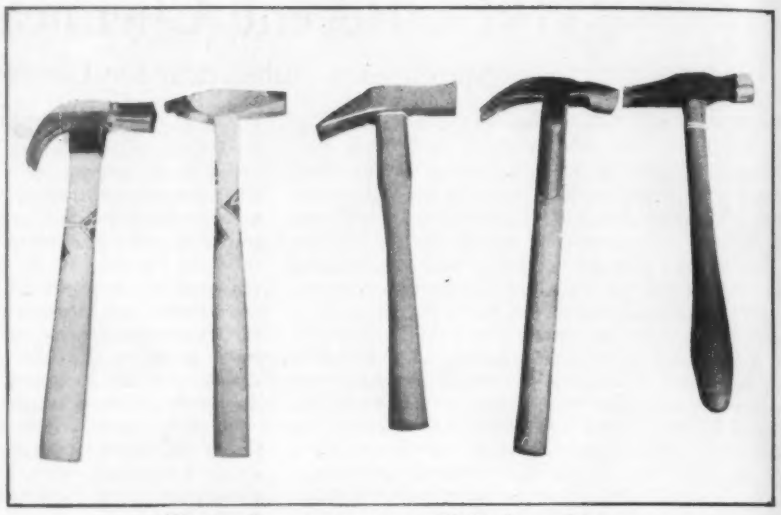


Comparison of American and European wrenches
Left to right, American heavy, British heavy, French light, American light



How our hammers compare with foreign makes
Two on the left American, third German, fourth British

American Hardware in Foreign Markets

By Hon. Edward Ewing Pratt, Chief of the Bureau of Foreign and Domestic Commerce, of the Department of Commerce

IT will surprise many Americans, and perhaps most Americans, to learn that American hardware enjoys a world-wide reputation for high quality, and that in many cases it sells for higher prices than articles made in other countries. It will be surprising because so many of us still cling to the belief that foreign products are better than our own. Once upon a time there was a sound basis for this belief—in the days when we produced raw materials almost exclusively and exchanged them for the manufactured products of the Old World. But there is very little basis for it today, certainly not so far as iron and steel products are concerned, and all the rest of the world knows it.

The excellent reputation enjoyed by our hardware, especially by our tools, is not based on some one quality and it has not been acquired in some spectacular manner overnight. It is based on general fitness for the work in view, upon design and balance, upon superior finish, and upon the high quality of the material used. It has been acquired in the course of the last two decades by persistent pushing on the part of American manufacturers who hold firmly to the belief that quality wins in the long run. They hold that in their efficiently organized American factories, with the ingenuity of the American designer and the skill and intelligence of the American workman, they can set the pace in the race for quality and hold it. They have not listened to the voice of the trade experts who advised them to compete against rubbish with rubbish. They have steadily refused to sacrifice the efficiency of a tool, for instance, to suit the whims or prejudices of consumers they wish to reach.

Probably in some cases they have been too unbending. Perhaps in some cases it would be better to model a hammer head, say, to suit the carpenters in some country, even if the carpenters are unreasonable to ask it. Among the experts who get their views into print there are two classes of extremists on this subject of conforming to the foreigners' tastes. One would have the manufacturer conform in every case. The other insists that he should not conform at all. As usual in such cases there is a happy medium.

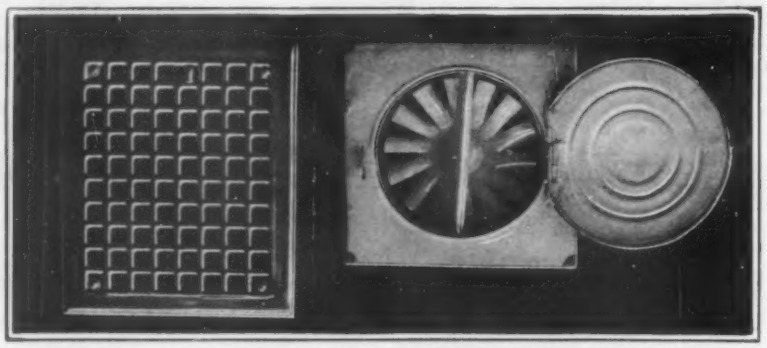
Where taste alone is concerned it is rather foolish to force something on the foreign consumer that he doesn't like. For example, if we can supply a condensed milk exactly like an article already in high favor in a community, it is foolish to try to force down their throats an article that seems strange and unpleasant to them. But where the efficiency of an article is the main or only consideration it is absurd to sacrifice acknowledged efficiency in order to imitate some article already familiar to the consumer. And in the matter of tools the American, I am glad to say, is usually justified in pushing his article just as it is on the ground that it is more efficient than those already in use. American locks are a good example. Our lock manufacturers were told years ago that their neat, compact locks and conveniently small keys could not be sold in many foreign markets because old-fashioned locks with their enormous keys had been used for so many generations that they would never be superseded. Very sensibly the American manufacturers refused to go back to methods they had abandoned 25 years ago. They went ahead and pushed their superior product on a quality basis and today their products are the standard the world over. Their most serious competition now comes from European imitations. This is the history of many other American articles, as well.

Competition from imitators is always annoying, but it is not so dangerous as competition from originators. When an American goes into a foreign market with a new device he profits at once from being the first on the ground. Later on the imitators come in with their copies, but the American has acquired a reputation. His article will be given the preference so long as prices are nearly level. His competitor must cheapen the product, and lower his profits, to stay in the market. And then the American probably will introduce other improvements, which the competitor must meet. The originator is always out in front setting the pace. The imitator is always struggling along behind taking the other fellow's dust. There is never any doubt about the ultimate verdict of the consumer. The imitator does not build on a solid foundation.

A great many pages could be covered in comparing American articles of hardware with the European-made products which compete with them in foreign markets, but I can make the point I have in mind more conveniently by considering a few typical articles, such as are familiar to every one. Take the carpenter's plane, for instance. In recent years American manufacturers have developed iron planes to take the place of the old wooden ones. These iron planes have been sold all over the world and have come into general use except among workmen who cannot pay the price. They are particularly popular in Australia, where the workmen are much like Americans in their willingness to adopt anything new that will fill the bill better than the old. The American maker absolutely holds the Australian market for this line. The brands that are most sold have established their reputation for quality, accuracy and adaptability. In Argentina the story is the same, for the metal planes are as popular there as in the United States. They have been gaining in popularity in France, where they are much appreciated, although the old-style wooden plane is still the more commonly used. In Russia the merits of the American plane are everywhere recognized, although the average workman feels that it is too high-priced.

Monkey wrenches are another line in which we excel. Our wrenches sell in all countries, and strictly on merit. In some districts they are sold in spite of rather formidable obstacles. In Chile, for instance, the monkey wrench is called "Lave inglesa" (English wrench), and the English market a very good wrench at a reasonable price. Yet the American wrenches are the most commonly used, although it is necessary for the buyer to ask for an "American English wrench." It is preferred because of the facility with which it can be handled, the class of material in the tool, and the satisfactory price. The Germans supply a low-priced wrench that is used only by the poorer class of workmen. I suppose some of our experts would advise the American manufacturers to put in a cheap wrench to get all of the business, but see what mischief would result if such a course were followed. At present we get the cream of the business, the American wrench is the standard, and even the poorest workman plans some day to have a fine American tool. If we sent in cheaply made wrenches it would result in lowering the reputation of our best wrenches, and of other tools as well. Even in Sweden the best grades of monkey wrenches to be had are made in America, and it must be remembered that in recent years Sweden has made very rapid progress in manufacturing high-grade tools. Here again the cheaper grades are supplied by Germany. In Russia, too, the American manufacturers get their share of the trade in the best grades of wrenches, although imitations are frequently met with.

It is significant that American auger bits have found an extensive market right in Germany. The peculiar construction of our bits gives them advantages over the ordinary double twist, in that while one-half of the twist is left out, forming a large receptacle for the chips, the double cutter is retained. This reduces the friction against the sides of the hole and allows the chips freely to pass up and out, which obviates the necessity of frequently withdrawing the bit to clear the hole. These



The American ventilator on the right is displacing that on the left, in Russia

Cabinet makers of South India using up-to-date American tools

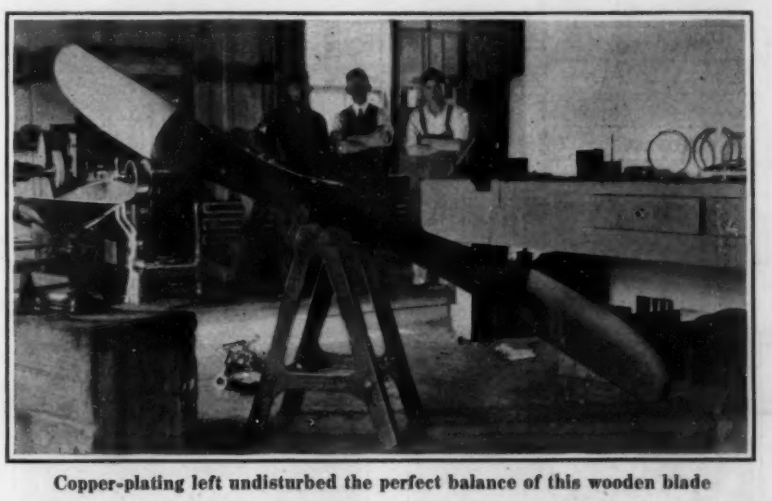
advantages are greatly appreciated by the German users. In Chile the American patent solid center stem bits for drilling wood are rapidly replacing practically all competing lines. There are some imitations on the market, made in Europe, but it is noteworthy that the makers of these imitations have not been able to get down to the American prices. In Argentina the popular, serviceable, and most frequently demanded bit comes from United States factories. No particular style is required, but the bits must be American. A serviceable tool is what the distributer and workman demand. In Brazil all of the better-grade bits in use are of American make. Some of the cheaper braces are made in Europe, but when heavy work is to be done American makes are demanded. The Russian workman, also, is familiar with the excellent qualities of the American bit and a good business is done there in the better grades.

Saws are a line in which the American manufacturer can hold his own in foreign markets even when he is obliged to charge more than his competitors. It is a fact that one well-known American firm controls almost the entire trade of Australia. What this firm doesn't get there other American firms do. European firms do a very small business, and that only by copying American models. Quality is the deciding factor in this market, as American firms have made no attempt to introduce the cheap grades. In Russia there is a somewhat different story to tell, for there the market for the lower-priced saws is so extensive that it must be catered to if any considerable business is to be done in the near future. The quality of the saws which have been purchased from the United States in the past has, of course, been satisfactory, but the prices of some classes have been so high (in some cases double those of German and English makes), that successful competition is out of the question. Most artisans use a web saw made in European countries, but in recent years there has been a tendency to turn to handsaws, and this should mean more business for American makes. Handsaws, hacksaw blades, and the like have hitherto been supplied almost exclusively by Germany, but there is no doubt that the United States could do a large business in these articles, as well as in the better grades of cross-cut saws, if arrangements were made for expert demonstrators. This would be expensive, but if the demonstrators got in touch with a few of the leading lumber and sawmill concerns in the north Russian, Caucasus, Ural and Siberian timber districts they could probably start sales. Thousands of saws are sold annually in some of these districts. Russia is a great wood-growing country and the development that will take place after the war will resemble in many ways the development that has taken place in this country in the last 25 years. We are preëminently fitted to supply the equipment for such development. But an active campaign will be necessary on the ground, and it should be started now.

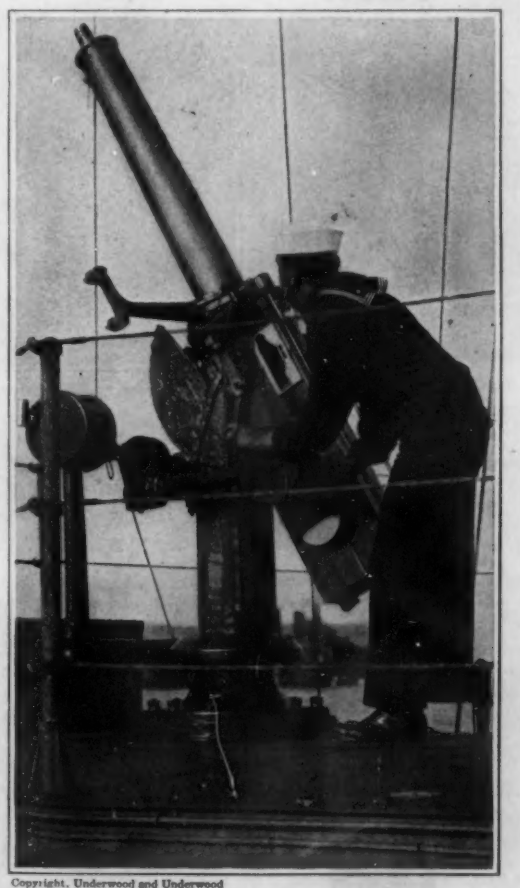
As might be expected, American axes and hatchets are supreme wherever the workmen can afford to buy them. It would be a sad commentary on the ability of our designers if all the wood-cutting we have done in this country hadn't produced the most efficient models of cutting tools. Australian woodchoppers, and there are no better the world over, use American axes exclusively. They are particularly attracted by a special model that has been made for them which has a wider blade than usual, and a more curved cutting edge. European manufacturers are reluctant to copy this axe or they have not been able to meet the price. Practically all hatchets used in Australia are American. In Russia conditions are much different, although immense quantities of wood are cut. European Russia is supplied with axes and hatches by Russian and Finnish manufacturers. American axes are liked but are considered too high-priced. In Siberia the American axe is extensively used, although Swedish and Finnish axes of good quality are found in greater numbers. The temptation to put cheap axes into Russia still exists, as it has existed for years past, but the American manufacturer refuses to yield. He believes that the preference for quality axes already existent in Siberia will extend to all Russia eventually, and for that reason thinks it will be the best policy in the long run to keep alive the impression that the American axe is the best on the market.

In handled tools, however, such as axes and hatchets, the American manufacturer has one natural advantage for which he is in no way responsible. He makes the handles of hickory wood, which is much better for the purpose than any other known. It is an American wood and the European manufacturer, finding no worthy substitute, must buy it from us or be at a permanent disadvantage. Only a few years ago the axes and hatchets that entered into foreign trade were shipped without handles, for it was then the custom for the importer or woodchopper or carpenter to supply the handles. At this time it was a difficult matter for the American exporter to hold his own. Some enterprising American, however, conceived the idea of selling the heads with the handles in them, just as he did at home, and he was instantly successful. Hickory not only established itself at once in the foreign markets as the one best material for the purpose, but the carefully finished and properly balanced handles won quick recognition from the workmen. Of course the American steel head has an excellent reputation, but the handle has a great deal to do with its success. I wonder if that American exporter knew how well he was building.

A copper-plated wooden blade



Copper-plating left undisturbed the perfect balance of this wooden blade



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One of the new anti-aircraft guns on a U. S. warship

There are many other articles, generally included under the term hardware, which the American manufacturer succeeds in selling in foreign markets in the face of competition from the older manufacturing countries of Europe, and almost always on the basis of efficiency, quality of material, balance and finish. The safety razor is to be found all over the world, although many cheap imitations of American makes are now sold. Vacuum cleaners are not unusual where there are people who can afford them. The American coffee grinder has made its way around the world. Our lawn mowers have made a favorable impression in some countries, even as far away as Russia. Our door checks were the first in foreign markets and have an excellent reputation. American screw drivers, plain and new fangled, are the standard in most countries. All these and many others sell on merit. Our manufacturers do not, as do many European manufacturers, depend upon some one point to sell their goods. Some European manufacturers put durability above everything else, and most of their products are heavier than need be. Others pin their faith to quality of material and superfine finish, and are consequently obliged to ask very high prices for tools of old-fashioned pattern that are not so efficient as they might be. Others seek to outsell their rivals on a price basis solely. The American way is to subordinate everything to the efficiency of the finished tool. It is not made heavier than is absolutely necessary, the best material is used, and much attention is given to the finish, although an article is seldom made merely fancy or ornamental. No attempt is made to turn out cheap rubbish, although American shop methods frequently make it impossible for foreign manufacturers to compete in price, quality for quality. Utility of design is our strongest selling point.

Of course there are many articles of hardware that we do not sell successfully

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Process of Copper-Plating Propeller Blades

BY a process of incrusting wooden, propeller blades, for aeroplanes, hydroplanes, etc., are now being coated with a thin layer of copper. This process of electro-plating copper on wood (or other materials if desired) is by no means new, but had never before been used for the above purpose, and this work is only in the experimental stage.

The advantages of copper plated propellers are numerous. They are stronger and give a better cutting surface, they will not become ragged-edged, they are protected from brush, etc., upon landing, and they possess many other advantages of less importance.

Excellent results in copper plating wood are accomplished as follows: Render the wood impervious to fluids by saturating it in a solution of wax or stearine varnish, then a coat of thick linseed oil varnish. Repeat this process until the mold is considered sufficiently impervious. Now coat the wood with a thickly fluid solution of shellac in alcohol and allow it to become thoroughly dry. Then place in a silver nitrate solution of four parts water and six parts alcohol. Drain off all excessive nitrate solution. Place the article for a few minutes in a closed vessel containing hydrogen sulphide fumes. This coats the article with a thin coat of silver sulphide. Repeat this process twice.

After having performed the above preliminary work, proceed to copper-plate in the usual manner. The following solution mixed with water to make 100 quarts gives best results:

44 pounds copper sulphate.
13.2 pounds sulphuric acid at 66 Be'.

Use about 20 amperes at start working gradually up to about 75 amperes at 4 or 4.5 volts.

New Naval Anti-Aircraft Gun

IT is a commomplace saying that every new weapon of offense ultimately and inevitably is met by some weapon equally efficient for defense. This has been proved in the matter of the Anti-Aircraft Gun, which is now of such long range and accuracy that it has forced the aeroplane to fly at double the height which was considered safe early in the war.

We illustrate one of the latest types of Anti-Aircraft Gun mounted on a United States warship. It will be noticed that the gun is of the water-cooled type. The telescopic sights are not yet installed, and the gunner has been placed at the gun merely to show him in position with his hands on the controls.

American Sources of Nitrogen

The Economic Production in the United States of Combined Nitrogen for Military, Agricultural and Industrial Needs

By Prof. Thomas H. Norton, Ph.D., Sc.D.

THE appropriation by Congress, in 1916, of the generous sum of $20,000,000, for the purpose of constructing and organizing government works, destined to produce nitrogen compounds in forms available for military requirements, as well as for general economic needs, shows clearly how public sentiment is awakened to the necessity of emancipating our country from all dependence upon other lands for our supplies of nitrogen in a combined form. It is timely, at this moment, to consider the exact nature of our needs of combined nitrogen, the various methods according to which these needs may be met by the utilization of domestic materials on American soil, the factors of cost of production as far as ascertainable, and finally to dwell upon the policy which might advantageously guide the expenditure of the large sum placed at the service of the War Department. The problem under consideration involves, as stated, the complete economic independence of this country from foreign sources of nitrogen in a combined form.

THE author of the accompanying article is well known to the readers of the SCIENTIFIC AMERICAN *through his contributions on "The Dyestuff Famine," "The Potash Famine," "The American Conquest of the Air," "A Census of Colors," and on allied economic problems. His extensive report on "The Utilization of Atmospheric Nitrogen," published by The Department of Commerce in 1912, is regarded by electro-chemists, on both sides of the Atlantic, as the most complete and exhaustive treatise on the subject in any language.*

—THE EDITOR.

Uses of Combined Nitrogen

The nature of this combination varies according to special industrial and agricultural needs. Agriculture can use, with very nearly equal advantage, combined nitrogen in any of the cheaper, current forms, in which it appears upon the market —Chile saltpeter, calcium nitrate (Norwegian saltpeter), ammonium sulfate, cyanamid, vegetable and animal waste matter. The percentage of nitrogen in the last category, as an essential factor in cost of transportation, is of prime importance in connection with questions of source and distribution. American agriculture *should* use ten times as much nitrogenous fertilizer, as is now the case, in order to utilize fully the arable area, and to derive maximum returns from the capital investment and from the normal expenditure by our farmers of human, animal and mechanical effort.

Industry requires a certain amount of ammonia, in the form of ammonium chloride, ammonium carbonate, etc., for diversified purposes. It further requires quite an amount of anhydrous ammonia for use in refrigerating plants. A considerable quantity of ammonia is needed in the manufacture of soda, because of the unavoidable waste in the Solway process. In general, the average annual consumption of ammonium compounds is large. It is not subject to serious fluctuations, but is steadily increasing.

Industry further requires very large amounts of nitric acid for the most diversified purposes. The leading use is in the manufacture of the explosives ordinarily required for quarrying, blasting and the like. The rapidly growing domestic dyestuff industry involves the use of great quantities of nitric acid, as well as of nitrous acid in the form of nitrites. The rapid expansion of American chemical industry in general means a notable increase in the quantity of nitric acid consumed.

Military needs involve the consumption normally of a large amount of nitric acid, in the manufacture of the powder and explosives required by the Army and Navy, for purposes of practice, etc., during times of peace. National defense requires the necessary nitric acid for the manufacture of a large reserve stock of munitions. It requires further the existence of a plant capable of furnishing at short notice an amount of nitric acid, far in excess of that normally consumed by the country, and quite independent of the plants yielding such normal supplies.

Sources of Combined Nitrogen

The sources of combined nitrogen available for the demands of organized industry and of the military establishment are as follows:

1. Chile saltpeter, for which Chile is the exclusive source. It is in general use as a fertilizer. It serves as raw material for the direct manufacture of nitric acid, and for transformation into the various nitrates employed in the arts, notably into potassium nitrate, ordinary saltpeter.

2. Ammonia.—This is obtained in seven ways:

(a) As a by-product in connection with the manufacture of gas, and especially of coke.

(b) As a leading product in connection with the distillation of the cheap lignites of our western states.

(c) As a leading product in connection with the use of the Mond process for the economical production of power gas, tar, and ammonia from coal, and notably from culm and coal refuse.

(d) As a leading product in the application of the Mond process to the production of power gas (especially for electrical purposes), tar, and ammonia from peat.

(e) By recovery from organic refuse matter by various patented methods.

(f) By production from cyanamid obtained through the fixation of atmospheric nitrogen on calcium carbide.

(g) By synthetic manufacture from atmospheric nitrogen and hydrogen by the Haber method. The only installation, thus far, is in Germany.

3. Nitric Acid.—This acid can be obtained in three ways:

(a) From Chile saltpeter.

(b) By the fixation of atmospheric nitrogen, using the arc process. The process is installed on a large scale in Norway, and on a small scale in the Alpine regions of Austria and France. It is dependent upon exceedingly cheap sources of electric power. An American method —the Rankin process—of considerable promise as regards yield and general economy in the cost of production, is just emerging from the experimental stage.

(c) By the oxidation of ammonia, (made by methods 2 a-g), using the Ostwald catalytic process. This process is installed in Germany. Prior to the war, it was in successful operation in Belgium.

Costs of Production

1. Chile Saltpeter.—The price is subject to wide fluctuations, dependent upon current demands, rates of freight from Chile, etc. Quotations for the 95 per cent grade, at New York, ranged from $2.15 to $2.47, per 100 pounds, during 1911, 1912, 1913. The current rate is $3.80. The export duty of $11 per ton, levied by the Chilean Government, is a heavy item in the cost. It might be lessened, or removed, in case of serious competition with what has been, hitherto, a Chilean monopoly. Unquestionably the price of Chile saltpeter could fall considerably below the rates of recent normal years, in case of pronounced competition with other forms of combined nitrogen.

2. Ammonia.—The cost of production, as secured from different sources, is quite variable.

(a) When ammonia is obtained as a by-product in connection with the distillation of coal for coking purposes, or for the manufacture of gas, the minimum cost of production can fall (as is the case with most by-products), to a figure but little above that representing the interest, etc., on the investment in the recovery plant, plus the cost of operating the same.

(b) In the recently established distillation at low temperature of our western lignites, primarily for tar, ammonia and gas, secondarily for coke (not metallurgical, for fuel purposes), the cost of

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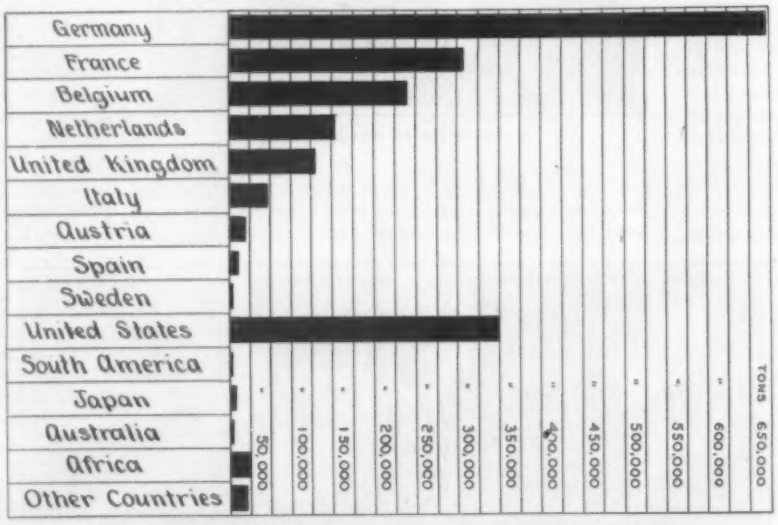
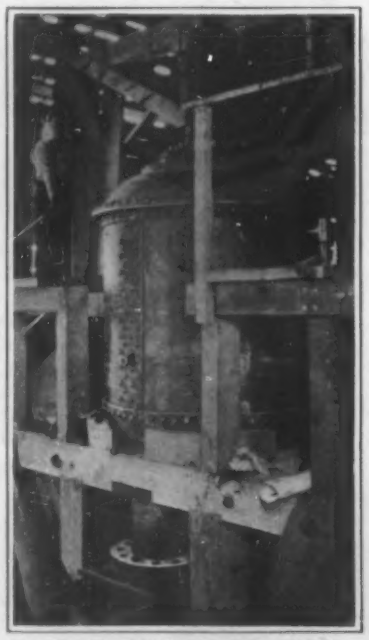


Consumption of Chile saltpeter, in metric tons, in the year 1908



The Rankin 250-horse-power electric furnace

Upper electrode of the Rankin furnace

First installation of the Rankin process for manufacturing nitric acid from the air, at Ludwig, Nevada

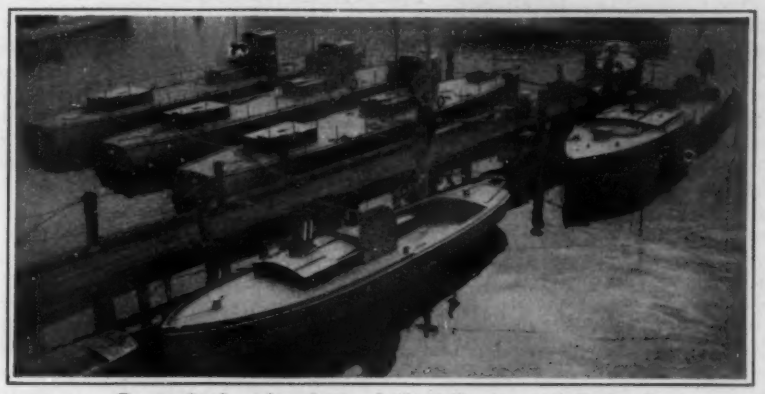
The electric furnace uses 250 H. P. The absorption towers are in the right foreground. The larger buildings are devoted to the leaching of copper base ores, by nitric acid, the latter being produced entirely on the spot.

Some Fast Submarine Chasers

THE accompanying views are of some fast submarine chasers which have been built at Greenport, L. I. The most interesting of these (shown at full speed on her official trial trip), was built for the United States Government. This boat is 50 feet long, 10 feet beam, 3 feet draft and her two 8-cylinder Duesenberg motors at 1,400 revolutions drove her on trial at a speed of forty-two miles per hour.

As far as we know this is the fastest submarine chaser in existence. She is designed to carry a three-pounder or a six-pounder gun forward, and aft it is proposed to mount a torpedo tube for firing torpedos of small size. The employing of torpedos on large motor boats is prompted by the fact that when the periscope is showing, the depth of the hull of the submarine can be closely estimated and the torpedo set to run at that depth. A hit at short range is quite possible.

The group of boats shown in the other photograph is a part of an order for 18 of these craft which were built for Russia and designed for use in the Baltic and White Sea. A subsequent order for a large number is under way and we understand that Great Britain took some of these craft for her own service. They are driven by three engines at a speed of 28 miles. These craft are about sixty feet in length and one of them, the "Chingachgook," which was taken over by the United States Government, has made with two engines a speed of about twenty-five miles.



Group of submarine chasers built at Greenport, L. I., for the Russian government

Length 50 feet, beam 10 feet, draft 3 feet. Driven by twin engines at 42 miles per hour

FASTEST SUBMARINE CHASERS

Monitor "Tallahassee" in a Seaway

IN 1900 to 1901 there was built a class of four monitors which marked an attempted revival in the United States Navy of this obsolete type of vessel. The ships were authorized by Congress in spite of strong opposition by the Navy Department. Congress, however, believed that these vessels would form a useful addition to our harbor and coast defenses.

At that time it was the policy of the Navy Department to build no ships of the larger and heavily armed and armored type that would not be able to go to sea and use their guns in any weather that might prevail. They objected to these little monitors on the ground that they were too small and possessed too little freeboard to be reckoned as seagoing vessels. The truth of this statement is seen in the picture which we publish herewith, which is a photograph taken from the bridge of one of these vessels, the "Tallahassee," when she was steaming into a head sea. The "Tallahassee" does not have very much more freeboard than one of the big German submarines when it is steaming at the surface; for the level of the main deck is not more than about four feet above the waterline. Consequently, when a monitor is steaming head to wind, she drives bodily into the seas and takes a large amount of broken water aboard.

The "Tallahassee" is of 3,225 tons displacement and 12 knots speed. She is armed with two 12-inch, 40-caliber guns and four 4-inch, rapid-fire guns. Her belt is from eleven to five inches in thickness and her turrets are armed with 11 inches. The "Tallahassee" is now being used as a submarine tender.

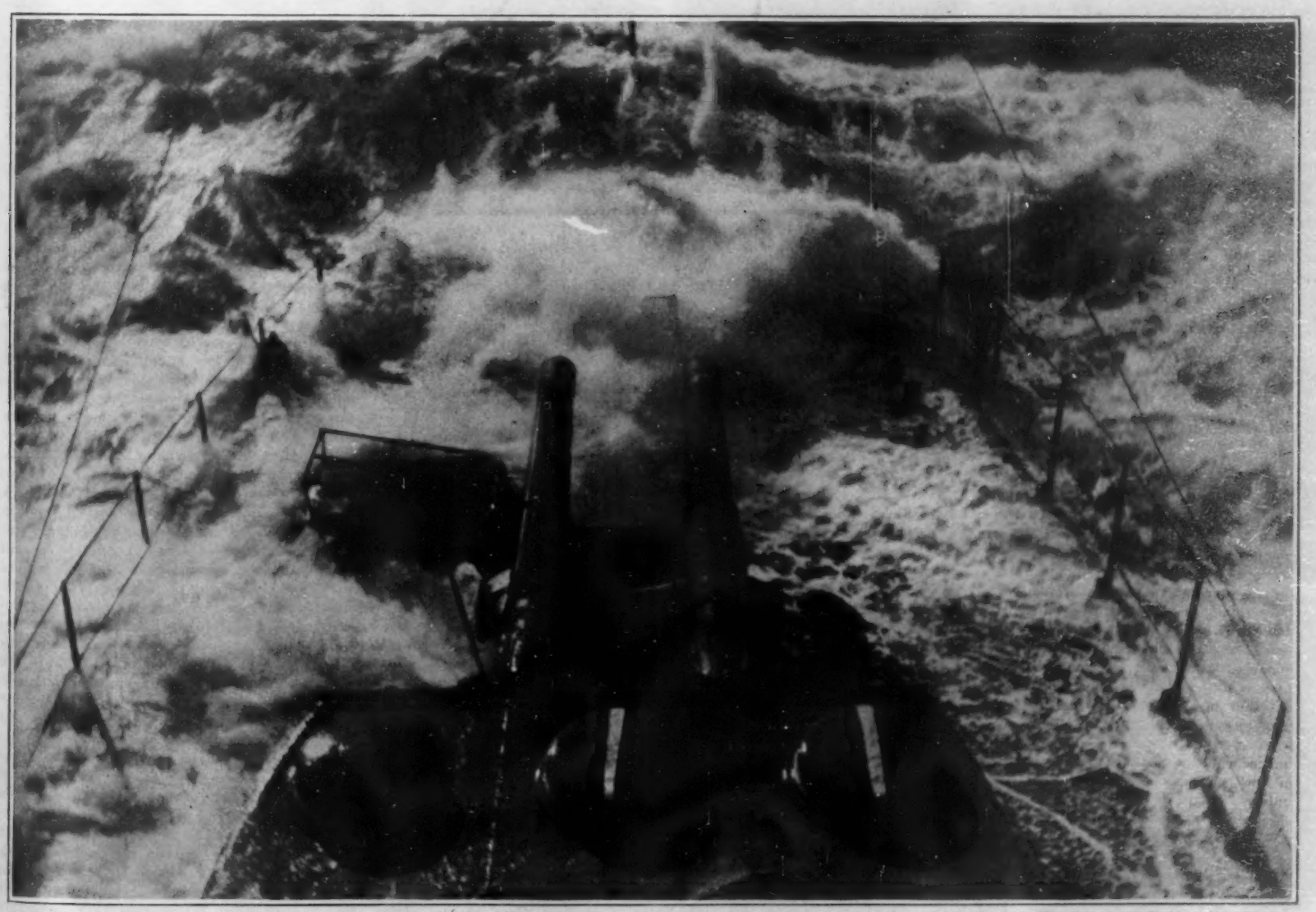
The Radio Inspector in the Rôle of Wireless Detective

NOT long since a responsible wireless amateur station in New York city picked up an S O S call and, following the usual procedure, relayed the call to the battleship "Arizona" then tied up at the Brooklyn Navy Yard. Several hours were consumed by the personnel of the battleship, the Navy Yard wireless station, and the coast guard cutters down the Bay, wirelessing queries to all vessels known to be near New York. When every ship had been checked up and found not to be in trouble, the Navy officials came to the conclusion that the distress call must be the work of some wireless amateur in the vicinity, indulging in what seemed to him a good joke on the commercial and Government wireless operators.

If the joker had stopped right then and there, perhaps no further attention would have been paid to the counterfeit call. But as it was he continued to send out distress calls, which at first troubled the responsible wireless operators, but later exasperated them. With a view to putting an end to this dangerous nuisance, Louis Krum, chief radio inspector for the Bureau of Navigation, Department of Commerce, decided to find the sender of the false alarms at any cost—to turn radio detective, as it were.

The S O S signals continued at intervals, so the work

(Concluded on page 411)



The low freeboard of about 4 feet of the monitor renders it a poor seaboat. It buries itself when steaming head to wind; its decks are constantly awash and because of its quick rolling it is a poor gun platform

MONITOR "TALLAHASSEE" STEAMING INTO A HEAD SEA

What I Can Do for My Country

II. The Electrical Engineer

THE electrical engineer is as indispensable as the chemist to a smooth working of our industries. But his services are given in a different way. The chemist, is intimately concerned with the technical details of the particular industry in which he finds employment. He devotes years of patient effort and hard work to becoming an expert in the chemistry of nitrates, of glass, of the coal-tar derivatives, of the food preservatives, of rubber, of soaps and fats; and in direct ratio with his success he disqualifies himself from serving in any other than the narrow field which he has chosen for his own.

With certain outstanding exceptions, upon which we shall duly dwell, this is not the case with the electrical engineer. While in very many instances he drifts into some subsidiary branch, the big work of his profession, the *raison d'etre* of its existence and recognition as a department of engineering rather than of mechanics, is the generation of power. The electrical engineer takes hold of our streams and our coal mines, converts their energy into electric power, carries that power to the locomotive and the lighting plant, the lathe and the loom, and sets up the apparatus which makes possible its application to each of these and to many other machines. To a notable extent it is a matter of indifference to him what we plan to do with his power after he has delivered it to us; his problem is rather classified in his mind with reference to the source from which we ask him to obtain power, the distance we require him to carry it, and the amounts in which we demand that he make it available for our use. For he is not a technical expert who enters a particular industry and through close contact with its problems becomes part of that industry. He is an outsider, looking in; he represents an industry, the generation of electric power, which is distinct in itself, but which finds itself superposed upon every conceivable other industry.

In looking about him to see what service he can best render the country in war, however, the electrical engineer whose experience lies in the direction of power generation must for the time being abandon his engineering point of view and descend to a level of utilitarianism. He possesses the knowledge and ability to supply power for any purpose. For what purpose can he best supply it to meet the nation's needs?

As in the case of the chemist, we cannot hope to answer this question completely. But just as we indicated some of the more important industries which are constant consumers of chemical service, so we can name some of the more important ones which are large consumers of electric power. The general statement will then hold that during the duration of the war no electrical engineer attached to any of these industries should under any circumstances leave this for other work; that since certain of these industries will have to operate upon an unprecedented basis of overtime, while others will be forced to radical expansion of their facilities, electrical engineers, attached to less vital industries should be prepared to transfer their services during the period of the war, and that their employers should be prepared to encourage this; and finally, that consulting electrical engineers should give first attention to calls from these essential industries,even to the extent of letting other work lapse entirely, if such heroic measures should be necessary.

We are inclined to place the service industries at the head of the roll of favored branches, with transportation first and lighting second. Aside from the question of moving troops, it is of course useless to manufacture anything at all for war purposes unless it can be carried at once and at highest speed to the point where it is needed most. And it is equally useless to undertake extensive and intensive war-time manufacturing if hours of labor are to be in any way restricted. The work of the lighting companies must proceed without hitch, in spite of the very heavy load which will be put upon their plants; and in the biggest centers of war-supply manufacturing, additional facilities for the generation of lighting current will doubtless be necessary. On the other hand, electrical transportation is by no means so trivial a matter as a vision of our heavy steam-hauled freight trains might make it appear to be. Sections of our great trunk lines far from negligible rely upon the hydroelectric plant for their motive power; and substitution of electric locomotives for their steam-driven predecessors proceeds apace. Moreover, there is hardly a street railway or rapid transit system of any consequence which does not carry hundreds or even thousands of workers whose labor is essential; and these lines are universally run by electricity. These two consumers of electricity must, then, be kept supplied at all costs.

The manufacturing industries may be considered next. And here we may appropriately turn to the catalog of war-time necessities which we gave two weeks ago in addressing the chemist. We there listed, in second place chemically, an item which easily takes first rank electrically. It would be as difficult to overestimate the rôle of electric power in the production of raw metals and their conversion into finished products as it would be to overstate the importance of these products in modern warfare. Electric power joins with chemistry in wresting the metal from the ore. Electric drive is as universal in our rolling mills as upon our lathes and planers; the variable load makes it, in both places, the only satisfactory source of power. For a man who is engaged in supplying that power to abandon his post for active army service or for more profitable employment would be the most reckless subordination of the nation's needs to the whims of the individual, no whit less reprehensible than the act of the soldier who deserts to find more congenial or more remunerative work.

Next to automobiles and aeroplanes, armor and shells and big guns, engines and motors and dynamos and shafting, and the machine tools that make possible these and, indeed, our whole modern age of metal—next to these, the most essential industry, alike in peace and in war, is the manufacture of the textile fabrics. The electrical engineer will agree that complete responsibility for keeping the looms of the country running and its spindles turning rests, nowadays, with him. The textile man will similarly endorse the statement that he has strenuous days before him, and that he will have need of all the aid the electrical engineer can give him if he is to keep up with the game.

As for the rest of the field, we shall make no specific statement. Every line of normal activity must be protected from decay and complete extinction, in war as well as in peace. The man engaged in supplying power to the great flour mills and packing houses will recognize that of all the industries not specifically placed in the front rank, these are probably the most necessary. The engineer whose power runs the printing press must decide for himself just what position of relative importance his work occupies, whether he should abandon it for another engineering job or for actual enlistment. The man who is supplying current to the furniture industry of Battle Creek will leap, in answer to a call for help from the automobile factories of Detroit, with considerable more alacrity than his professional colleague will display in changing over from the silk mills of Paterson to the cotton works of Passaic. In the long run we can but suggest,. leaving to the individual the final decision as to the department of industry in which he can most wisely apply his ability to create power.

Whether or not he be directly engaged in the production of electric power, whether he be a general engineer who plans, a plant engineer who sets up, or a traffic engineer who operates, the remarks so far made apply with more or less force to every member of the electrical engineering profession. The traffic engineer, however, is apt to find that, like the chemist, his general ability has suffered from long specialization upon some particular problem or class of problems. Wood working machinery, reciprocating pumps, traction motors, heavy cranes, elevators, punch presses, fans, printing presses and textile machinery present to the electrical engineer their individual features, their own peculiar difficulties, which in no two cases are alike. A man whose work has been confined for five years or more to setting up and keeping in order installations of some one parricular type should by all means consider the narrowing influence of this confinement in deciding where he can be of most use in the prosecution of our war-time activities.

Another feature which the traffic engineer should be sure that he does not overlook, is the opportunity for useful work as an enlisted man in the navy. Our big naval vessels carry a vast amount of electric equipment, and, to operate it, power stations that would be a credit to any but the very largest municipalities. Each ship has to have its complement of men able to handle its electrical problems promptly and efficiently; and if an electrical engineer feels that he must enlist, that the relative unimportance of any civil work which he would be likely to find makes it advisable for him to enlist, by all means let him select the navy, where he can at the same time enlist and find a field for his special knowledge.

In addition to these engineers, both army and navy will make heavy demands upon the supply of men versed in electric communication—telegraph, telephone and wireless. This field, being a natural monopoly, is in actual practice, save as the wireless is in the hands of government and amateurs, almost wholly controlled by a single company and its affiliated concerns. Hence it has been possible here as nowhere else in the electrical field to institute coöperation between government and employers; and it has been definitely arranged that the government's needs for Signal Corps engineers will be met in full by the telephone trust. Already five hundred men have been detached from company service, a number which it is estimated is sufficient to meet the present requirements of the government. The plan was worked out in conference between executives of the company and officers of the Signal Corps. The present contribution to government service has been secured by calling for volunteers, however, so that even here the initiative has not been completely taken from the men.

In this body are men competent to plan, set up, and operate telephone, telegraph and wireless plants of any magnitude. In case of necessity they will be used to help out in the naval work. A notable feature of the equipment as worked out by these men will undoubtedly be the wireless telephone perfected by their company last year, and so far never used in field operations.

Whether the normal needs of the company furnishing these signal engineers will suffer from their absence cannot yet be said. Since the quota of five hundred is little more than ten per cent of the total number now on the company's payrolls, it would seem that, for the present at least, there will be no serious effect. If the demands upon the company's engineering resources are later materially increased, however, it will be seen that service must fall off or the company will have to call for volunteers from the general population. This will bring the situation within the power of the general engineering community, and telegraph and telephone engineering will be added to the list of temporary war-time professional activities. Perhaps the wireless amateur will then have something to say for himself.

Another man who should realize that his case is a special one, is the production engineer of the electrical supply company. Of course if he be merely engaged in designing and supervising the manufacture of novelties and toys of no practical value our interest in him extends only to winning him over into more useful work of some sort. But it is not of such men that we speak. There are, in responsible positions with factories turning out lamps and batteries, motors and dynamos, telegraph and telephone and wireless apparatus, rheostats, solenoids, induction coils, electric measuring instruments, thermostats, etc., many electrical engineers holding degrees from the recognized institutions, and many more electrical near-engineers who have qualified in the university of hard knocks and practical experience. While none of these men is an Edison or a Marconi or a Tesla or a Siemens, many of them do excellent work in designing, experimenting and testing, all of them give services of the utmost value as a contribution toward high standards of production, and a large majority of them are replaceable only by the same gradual process that brought them into their present positions. Nowhere is the general unfortunate tendency toward enlistment of the man who can least be spared more pronounced than among this particular class. One of the largest lamp factories faced complete disorganization of its staff of high-class men at the time of the Mexican crisis last year, and now that we are confronted with a real war the situation will doubtless be even more acute.

There are, the country over, thousands of these production engineers whose presence at their posts is imperative, if the quality of our electric equipment is not to deteriorate, carrying with it our electrical engineering and our work in all dependent lines. These men, therefore, *must* stay in their places; and if they refuse to be educated into doing so of their own volition, means must be found to compel them. We have little hesitation in saying that they constitute the most pressing problem of our mobilization.

THE first article of this series, suggesting to the chemist the chief avenues toward national usefulness which are laid open to him by our entry into the war, appeared in our issue of April 7th. We present herewith the corresponding material for the electrical engineer. He will find that in most instances, especially if he be directly engaged in the industrial production, transportation or application of electric power, or in the manufacture of electrical equipment, he will attain his maximum value to the country by sticking at his present work. On the other hand, it is to be noted that the actual armed service offers him far more opportunity for exercise of his professional talents than it does to the chemist. If he feels driven to enlist, he is accordingly urged to offer his services as a naval electrician or as a member of the Signal Corps.

EDITOR

The Motor-Driven Commercial Vehicle

Conducted by VICTOR W. PAGE, M.S.A.E.

This department is devoted to the interests of present and prospective owners of motor trucks and delivery wagons. The editor will endeavor to answer any question relating to mechanical features, operation and management of commercial motor vehicles

Motor Trucks as Steam Shovel Auxiliaries

A LARGE steel company recently appropriated $100,000,000 for plant extensions and in the erection of a blowing engine house for a blast furnace at Sparrow's Point, Maryland, encountered a problem in excavation work that was successfully solved by the combination of steam shovels and motor trucks. It was decided to use the material excavated to fill in low and partially submerged areas near the proposed plant. Rails were put down and small dump cars were employed, but soon it became apparent that the cost of tearing up the rails to reach each new dumping point was prohibitive, and that this process greatly delayed the progress of the work. A fleet of 66 five-ton trucks of a leading make, three steam shovels and other equipment made it possible to perform the work in a minimum of time with a great saving over the cost of hauling the material in dump cars. In fact, the costs were cut in half as soon as the trucks were put into service. Despite the fact that the ground was covered with 12 to 15 inches of soft black mud, the trucks were able to move their loads much faster than the dump cars and they had the further advantage of being able to deposit their loads in many different places without waiting for tracks to be moved. It is said that for several weeks the trucks were successfully operated in water nearly up to the hubs. The accompanying photograph shows clearly the unfavorable conditions under which the trucks operated.

Combination of motor trucks and steam shovels cannot be surpassed for economical excavation and grading work

Rescue Truck for Mine Disasters

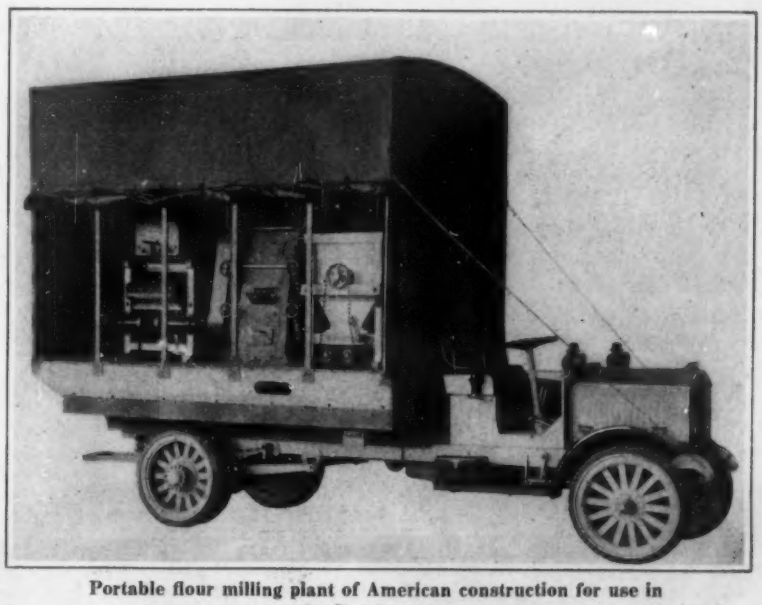
RESCUE stations equipped with motor trucks having complete paraphernalia for relief work, permit of giving quick aid to victims of mine disasters, and the fast motor trucks attached to these stations are helping to reduce the suffering of the injured and entombed miners following the periodic disasters in coal mines. Scores of lives have been saved, imprisoned workers rescued from poisonous gas fumes and fire, unconscious victims have been resuscitated and heavy property damage averted by prompt action. The accompanying photograph shows one of these motor truck units in the rescue service with the six members of its crew ready for action. A ¾-ton truck chassis is adequate to carry the equipment and it is provided with pneumatic tires to permit of making the required speed when answering alarms. The truck pictured is one of several which have been designed especially for the work of the U. S. Bureau of Mines, which are to be stationed at important coal producing centers. It will be used for educational work in the State of Washington for a time and will then be placed in service in Seattle to serve the adjacent mining industry.

The truck is in charge of an expert specially trained in mining and rescue work. Oxygen helmets are worn by the men enabling them to penetrate far into subterranean tunnels, laden with the most poisonous gas or smoke and bring the unfortunate victim to the surface where pulmotors, oxygen tanks or other means are employed to revive them. For this work the motor truck carries special equipment such as fire extinguishers, hose, axes, safety lanterns, miners' tools, crowbars, drills, saws, picks, shovels, rope, compasses and a complete set of surgical dressings and instruments. A portable telephone is usually carried down into the mine to enable the members of the crew to communicate with the surface workers.

Special motor truck used for rescue work by the U. S. Bureau of Mines

Portable Milling Plant For Russian Army

IT is stated that while the Russian Government has a good supply of grain, the lack of milling and transportation facilities has made it difficult to deliver flour to the armies in the field. This trouble has been overcome by a portable milling plant mounted on a 3½-ton motor truck chassis, which can follow the army and which can grind the wheat into flour right on the battle-front. The truck which is illustrated herewith has a special body of large capacity in which all of the milling machinery is housed. The curtains may be raised to admit light when the mill is in operation or the machinery may be entirely enclosed to protect it against inclement weather. This outfit has proved to be very practical for war purposes and a number have been ordered by the Russian Government.



Portable flour milling plant of American construction for use in the Russian army

The machinery was supplied by a prominent American manufacturer of flour-milling machinery and is arranged so that the motor truck power-plant can be utilized to furnish energy for driving the mills. A friction clutch is mounted on the propeller shaft in order to provide a connection which may be made or interrupted at will between the source of power and the machinery. A silent chain drive is utilized in connection with the clutch and is brought into action when it is desired to transmit the engine power. It is understood, of course, that when the mill is being operated the truck is stationary. The mill is a short-roller system with a capacity of 25 bushels of wheat flour per hour. There is a three-reduction mill for grinding and a complete cleaning and bolting equipment. In addition, the necessary elevators and conveying equipment for making the system automatic is provided.

The motor truck chassis also of American design weighs, with equipment, about 14,000 pounds. The frame is a substantial structure of pressed steel channel section and is supported by semi-eliptic springs. The wheel base is about 160 inches long. The rear axle is of full-floating worm-gear type. A three-speed gear box and a large cone clutch are used to transmit the power. The engine is a four-cylinder four-cycle vertical type. The cylinders are cast in pairs and have a 4½-inch bore and 5½-inch stroke. The maximum speed of 1,250 R. P. M. is controlled by a sealed governor. Lubrication is effected by positive plunger pumps which supply oil to the bearings from which it overflows into crank case troughs in which the connecting rods dip. Ignition is furnished by high-tension magneto, and a multiple jet carbureter is used to secure economy of operation. Specially robust brakes are provided and radius rods are fitted to take the propulsive effort. The gasoline capacity is twenty gallons and the fuel is carried in a seamless pressed-steel tank located under the driver's seat. The steering wheel is placed on the left-hand side and center control levers are provided.

The Current Supplement

THE article on *Training in Military Aviation*, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2155, for April 21st, tells how the work is done in England, and is timely in view of the great number of these experts that will be required in this country in case of active hostilities. *Distant Control of Aircraft by Whistling* describes a device by which an aircraft, such as an aerial torpedo, may be maneuvered at will. It is accompanied by an explanatory diagram. The illustrated article which treats of *Quantity Production* touches on the great influence modern methods of manufacturing automobiles has had on machine construction and improved mechanical processes, by which it is possible to produce fine cars at a price within the reach of the general public. *Damage to Seasoned Hard Wood by Lyctus Beetles* describes insects dangerous to valuable woods, and tells of remedies and methods of preventing their inroads. *Anomalies of the Animal World* is a second instalment of the valuable papers describing curious animals that are appearing in the SUPPLEMENT. It is accompanied by numerous pictures. *The Non-Recoil Gun* describes and illustrates an ingenious weapon that promises to be of great service on aeroplanes, small submarine chasers and in many other cases where a light and mobile weapon is needed. The paper on *The Healing Art* is concluded in this issue. There are a number of other readable articles, including *A Novel Superheater*, which is illustrated: *Industrial Fatigue*, *The Romance of Radium* and *Welding in Gas Main Construction*.

Philippine Horses

ACCORDING to Mr. D. B. Mackie, writing in the *Journal of Heredity*, the Philippine horse is not, as has been generally supposed, a descendant of horses brought to the islands from Mexico and Spain by the Spaniards. The bulk of the horses imported by the early colonists were Chinese. Moreover, horses existed in certain parts of the archipelago before the Spanish conquest, and these originally came from Malaysia. Horses were also introduced from several other regions, so that modern Philippine horses contain large or small amounts of characters from Chinese, Japanese, Mexican, Persian, Indian and Sumatran sources.

SILVERTOWN CORDS SAFETY TREAD TIRES BICYCLE TIRES CARRIAGE TIRES AIR BRAKE HOSE

GOODRICH

THE MOTIVE POWER OF GOODRICH

TRADE MARK

WHATEVER "looks easy" is doomed to THE COMMONPLACE.

The *air ship* and the *submarine* were sensations till the people discovered the former *flew* 'just like a bird' and the latter *swam* 'like a fish.'

The same drab fate besets the modern miracle—TRANSPORTATION.

SPEED, COMFORT and SAFETY we exact of modern transportation as *commonplace* rights of travel. They become important only in their ABSENCE.

Yet the locomotive would jolt along at a snail's pace without *comfort* and safety; the ocean liner would waddle like a land crab; and the automobile not exist at all BUT for rubber—GOODRICH RUBBER.

WORDS can not exaggerate the dependency of modern transportation on Goodrich and Goodrich rubber. They dominate every phase of travel, every form of portage. Even the Japanese jinriksha runs the *faster* and *easier* for Goodrich solid rubber tires.

Incidentally Goodrich made the *first* solid rubber tire and therewith revolutionized the whole carriage industry; just as Goodrich's Steel Base Rubber tire changed the auto truck from a clumsy, wasteful monster to an efficient dray.

Yet Goodrich's fulfillment of the needs of transportation are but a finger's breadth in the span of the day's work of the Goodrich factories at Akron.

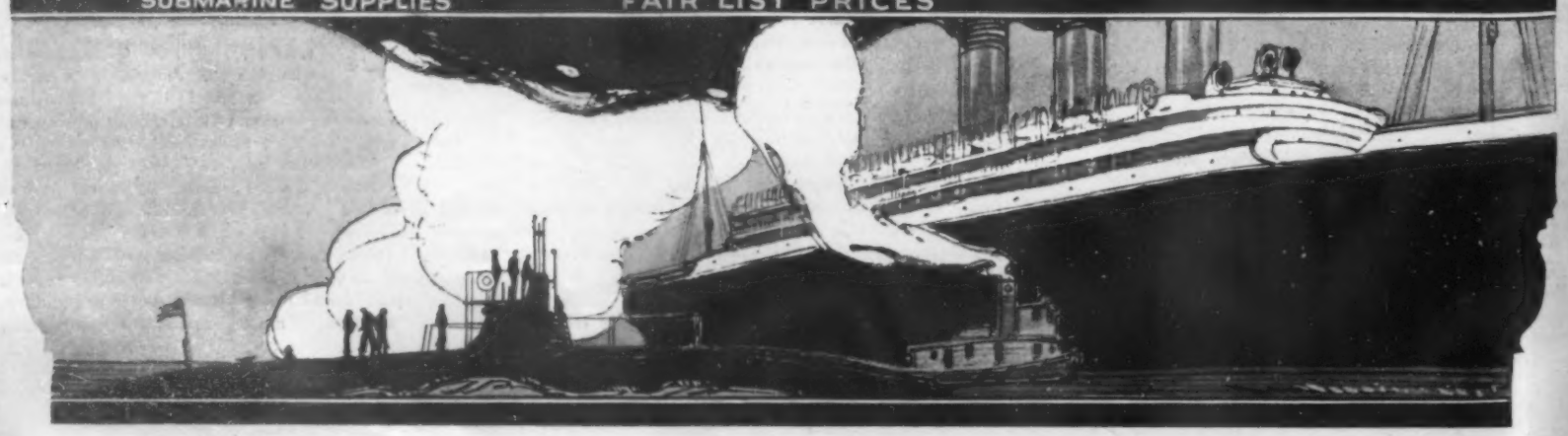
Goodrich would *still* be Goodrich without transportation, but transportation could not be MODERN without Goodrich.

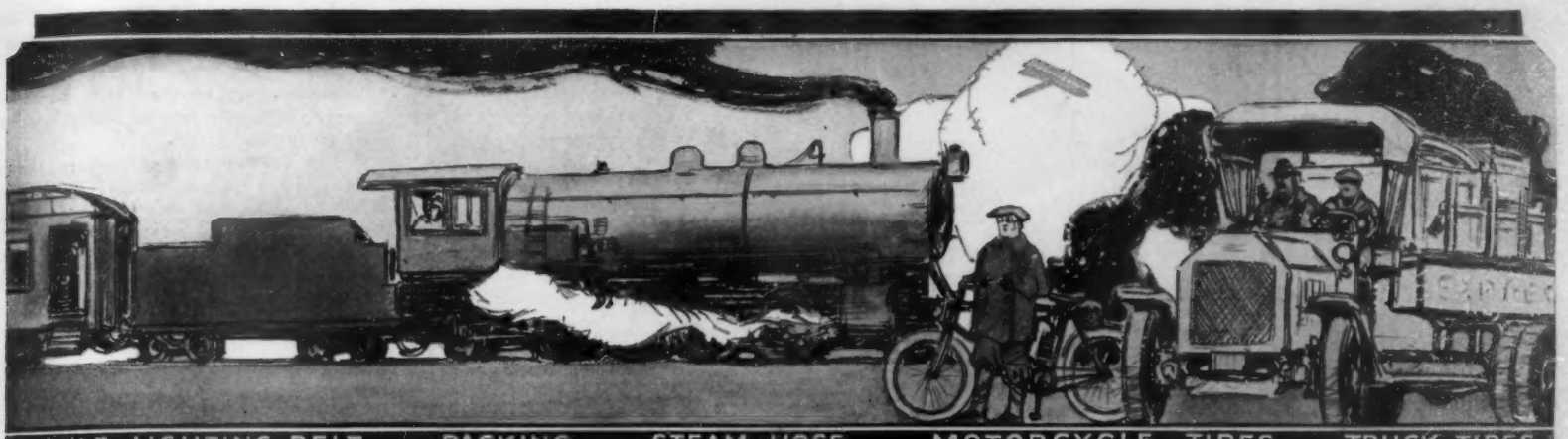
GOODRICH literally keeps the automobile industry on the move, and actually insures the existence of the automobile through the *rubber pneumatic* tire.

Yet Goodrich does not make automobile tires—or their prototypes, bicycle and motorcycle tires—because of a mere *demand*, but because Goodrich is in the *business* of *providing rubber*, whether it is a rubber band for your last will and testament, or tires for your automobile.

The horseless carriage had to have rubber-tired wheels, hence Goodrich science and experience in rubber automatically bent to the tasks of providing them.

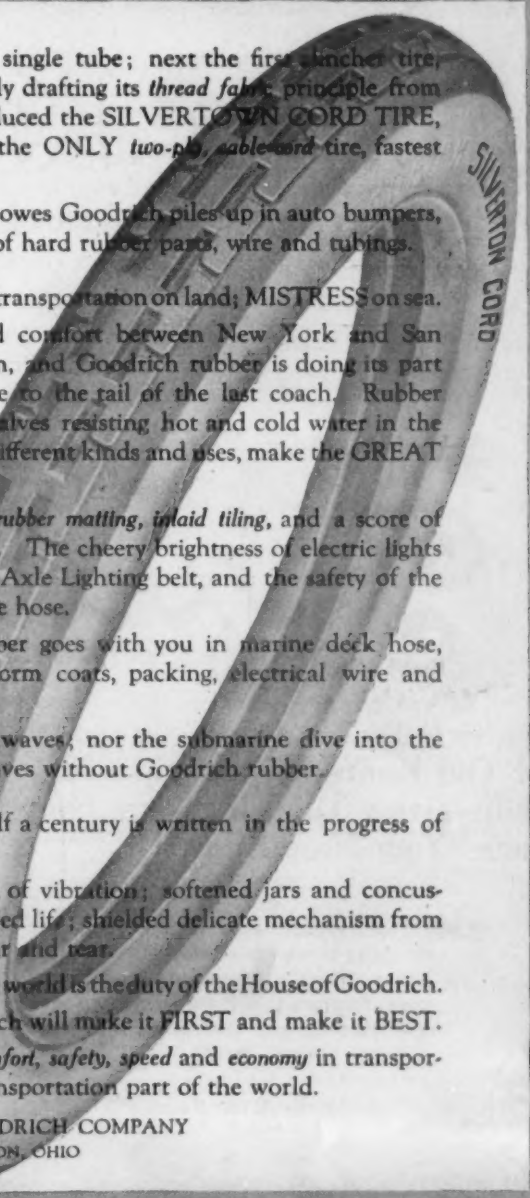
SUBMARINE SUPPLIES FAIR LIST PRICES





AXLE LIGHTING BELT PACKING STEAM HOSE MOTORCYCLE TIRES TRUCK TIRES

GOODRICH



GOODRICH to begin evolved the single tube; next the first clincher tire, the type in use today; and finally drafting its *thread fabric* principle from Goodrich bicycle tire experience, produced the SILVERTOWN CORD TIRE, introducing *alone* and *ahead* and *still* the ONLY *two-ply, cable-cord* tire, fastest and most durable of tires.

And further, the debt the automobile owes Goodrich piles up in auto bumpers, horn bulbs, mats, battery jars, scores of hard rubber parts, wire and tubings.

GOODRICH rubber is MASTER of transportation on land; MISTRESS on sea.

You are shuttled in safety and comfort between New York and San Francisco on a lightning express train, and Goodrich rubber is doing its part from the headlight of the locomotive to the tail of the last coach. Rubber packing tripling the power, rubber valves resisting hot and cold water in the engine, and *hose* and *tubing* of a dozen different kinds and uses, make the GREAT MOGUL the miracle of speed it is.

Throughout the train *rubber buffers, rubber matting, inlaid tiling,* and a score of rubber ingenuities serve your comfort. The cheery brightness of electric lights would be wanting without Goodrich Axle Lighting belt, and the safety of the air brake without Goodrich Air Brake hose.

Travel to sea, and the Goodrich rubber goes with you in marine deck hose, collapsible buckets, rubber boots, storm coats, packing, electrical wire and transmission belts.

The dreadnaught could not plow the waves; nor the submarine dive into the deep; nor the hydroplane ride the waves without Goodrich rubber.

THE *progress* of *transportation* for half a century is written in the progress of Goodrich and Goodrich rubber.

Goodrich rubber has taken the shock of vibration; softened jars and concussions; provided comfort and safeguarded life; shielded delicate mechanism from ruin and hardier machinery from wear and tear.

ALL because the DUTY of rubber to the world is the duty of the House of Goodrich.

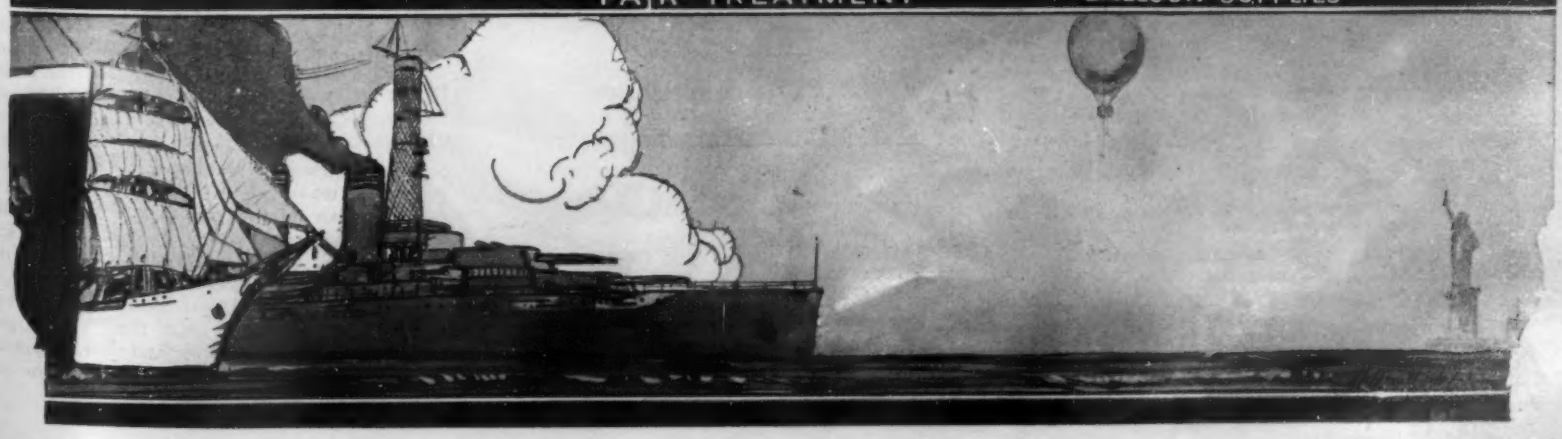
Whatever is needed in rubber, Goodrich will make it FIRST and make it BEST.

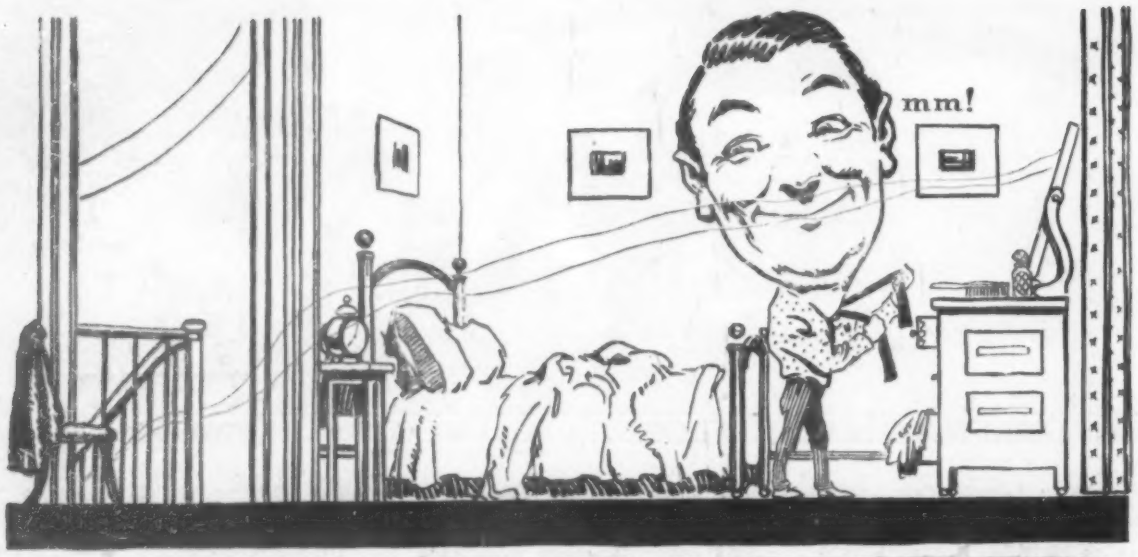
Because Goodrich rubber has put *comfort, safety, speed* and *economy* in transportation, Goodrich IS rubber to the transportation part of the world.

THE B. F. GOODRICH COMPANY
AKRON, OHIO

TRADE MARK

FAIR TREATMENT BALLOON SUPPLIES





HOW do you know there's ham and eggs for breakfast?

"Your Nose Knows"

By that appetizing *fragrance* that comes up-stairs to you—promising you the first delight of a new day. Fragrance is an indisputable guarantee of goodness. Just so the *pure fragrance* of a good tobacco guarantees a wholly satisfying smoke. Fragrance is a true guide. Trust it—"Your Nose Knows."

Its *pure fragrance* is the charm of

Tuxedo

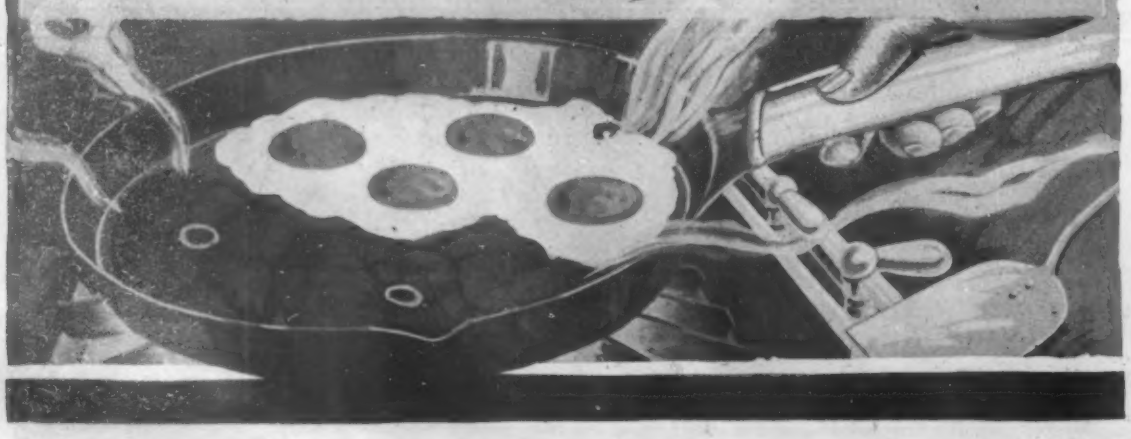
The Perfect Tobacco for Pipe and Cigarette

Its tender, rich Burley leaves, grown in the Blue Grass region of Old Kentucky, are ripened and blended with expert skill—giving Tuxedo a *pure fragrance* all its own, a fragrance "Your Nose Knows!"

Try this Test:—Rub a little Tuxedo briskly in the palm of your hand to bring out its full aroma. Then smell it deep—its delicious, *pure fragrance* will convince you. Try this test with any other tobacco and we will let Tuxedo stand or fall on your judgment—

"Your Nose Knows"

Guaranteed by
The American Tobacco Co.



A Unit System for the Packing and Handling of Artillery Ammunition

(*Concluded from page 385*)

appreciated and accepted by the ordnance experts intimately familiar with this branch of the service.

The built-up type of package already described is cheaper when compared with the old-style chest, and is about one-half the cubic size as calculated by the extreme outside measurements. This is particularly significant at this moment when there is a dearth of ocean-going ships, and every cubic foot of space must be made to count. Then again, the new method makes for a solid, compact package, supporting the finished round firmly and with more surface contact than the three-point supports of the usual shell box. The jackets being absolutely waterproof, the rounds are protected from water as contrasted to the usual box with which there is always present the danger of water entering and, in cold weather, the possibility of the finished rounds becoming frozen tight and fast inside the box.

From a utilitarian standpoint the pressed-steel end pieces of the new shell package are most welcome at the front, where they can do service as cooking and washing pans, and in other equally-useful capacities.

In action, when served naked, brass shells in daytime invite the danger of sun-flash reflections, and in this manner are apt to betray the position of the battery to enemy airmen. Also, naked rounds are easily dented or cut open by small shrapnel fragments, whereas the tubular jacket would obviously safeguard the brass case. Again, ammunition passers when stumbling or wounded would dent and damage unprotected rounds; but when served in the jacketed tubular package as single charges for the gun, this danger is effectively eliminated.

It is in the event of a forced retreat or a sudden advance or change of position that the new invention is particularly advantageous, for it permits the rounds to be distributed and easily carried in the form of safe and handy units, whereas heavy, unopened old-style boxes would be cumbersome and invite delay, not to mention the further danger of grouping two or more men in each case to lift and carry the heavy box. Single naked rounds, on the other hand, are difficult to hold, being slippery and easily dropped and damaged if roughly handled, while the new shell-jackets are readily and safely handled either during the day or night, and more easily passed along from hand to hand through wet and muddy trenches.

Should the ammunition, equipped with Mr. Steinmetz's shell-jacket, be stored, either in underground depots or in surface dumps, the work will be found quite simple, since the single unit case can be roughly stored or even buried in the moist earth without danger or damage. And in this connection, as well as in all others, the cardinal feature of the invention is that the shell reaches the gun clean and in perfect condition, no matter through what it may have passed in transportation and in storage at the front.

Public Water Supplies in Michigan

THE valuable popular monthly journal of the Michigan State Board of Health, *Public Health* recently presented an inventory of the public water supplies of the towns and villages of that state. Such a list is especially interesting to the traveling public, and above all to summer visitors; hence it is to be hoped that the health authorities of other states will follow suit. The names of towns and villages are given in alphabetical order, and after each is a statement as to whether the water supply is municipal or private; the source of the water (lakes, rivers, deep or shallow wells, etc.); methods of purification, if any, and frank opinions as to the quality of the water. The Board does not hesitate to say, for example, that the village of Ford gets its water from the "grossly polluted" Detroit River, and that the typhoid rate is enormous—the highest in the state.

Where Somebody Knows

What is the job you have for those motors? Are they to operate mine pumps or envelope sealers, washing machines or smelter machinery, oil wells or steel mills?

Whatever the kind of service, you want motors and control apparatus to meet your own particular requirements. And that means it's up to the engineers who tackle your problem to solve it no matter how different or difficult it is.

Here's where Westinghouse is exceptionally well-equipped to serve you.

For not only does the Westinghouse engineering staff include a great number of experts in designing and applying various kinds of motors, but every engineer commands the knowledge and experience of every other engineer in the big Westinghouse corps. Furthermore, he can draw upon the great store of information contained in Westinghouse records, including the analyses of many thousands of motor applications.

Let a problem arise with some aspect of which the engineer on the job is not familiar, and he has but to turn to some other Westinghouse engineer or the record files for the assistance he needs.

Whether the question be electrical or mechanical, somebody in the Westinghouse organization knows the answer.

Few problems of motor application are just alike. Each needs individual consideration. Yours may present just those features that will make the extensive engineering resources of Westinghouse worth thousands of dollars to you.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY
East Pittsburgh, Pa.

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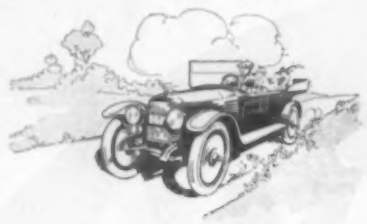
ELECTRIC MOTORS AND CONTROLLERS



Higher-speed engines have put your lubricating oil on its mettle

A number of cars are now equipped with engines capable of an engine speed of from 2000 to 2600 revolutions per minute—some over.

To realize the meaning of this new demand on lubrication, we must know what 2600 r.p.m. means.

Every second the magneto must furnish 21 individual sparks in each cylinder. 21 times *per second* the temperature, at time of ignition, reaches from 2000° to 3000° F.

In an engine having, for instance, a bore of 3¼" and stroke of 4½", during each *second* each piston travels over a surface equal to about 27 square feet.

If the combined heats of combustion and friction were permitted to continue unchecked, the cylinders would soon be a mass of molten metal.

Destructive friction-heat must be prevented. The burden falls sharply on a thin film of lubricating oil—seldom over .003 of an inch thick.

If the oil is of poor quality this thin film stands in great danger of breaking down.

A prominent manufacturer of tractors recently made the following severe test—

A tractor pulling 6500 pounds on drag was driven for 30 minutes through mud ten inches deep. With a supposedly good oil the water in the radiator reached boiling point in 17 minutes. On replacing this oil with the correct grade of Gargoyle Mobiloils, the boiling point, under the same operating conditions, was not reached until 27 minutes had passed by.

This plainly indicates better lubrication and a marked reduction of friction heat.

Write for new 56-page booklet containing complete discussion of your lubrication problems, list of troubles with remedies and complete Charts of Recommendations for Automobiles, Motorcycles, Tractors and Marine Engines.

GARGOYLE

Mobiloils

A grade for each type of motor

In buying Gargoyle Mobiloils from your dealer, it is safest to purchase in original packages. Look for the red Gargoyle on the container. If the dealer has not the grade specified for your car, kindly write our nearest branch, giving dealer's name and address.

VACUUM OIL COMPANY
Rochester, N.Y., U.S.A.

Specialists in the manufacture of high-grade lubricants for every class of machinery. Obtainable everywhere in the world.

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Correct Automobile Lubrication

Explanation:—The four grades of Gargoyle Mobiloils, for engine lubrication, purified to remove free carbon, are:

Gargoyle Mobiloil "A"
Gargoyle Mobiloil "B"
Gargoyle Mobiloil "E"
Gargoyle Mobiloil "Arctic"

In the Chart below, the letter opposite the car indicates the grade of Gargoyle Mobiloils that should be used. For example, "A" means Gargoyle Mobiloil "A," "Arc" means Gargoyle Mobiloil "Arctic," etc. The recommendations cover all models of both pleasure and commercial vehicles unless otherwise noted.

Model of CARS	1917 Summer	1917 Winter	1916 Summer	1916 Winter	1915 Summer	1915 Winter	1914 Summer	1914 Winter	1913 Summer	1913 Winter
Abbott-Detroit	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
" (8 cyl)			A	A	A	A				
Allen	A	Arc.	A	Arc.	A	Arc.	A	A	A	A
" (Mod. 32-34-35)					A	Arc.				
Apperson	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (8 cyl)	A	A	A	A						
Auburn (4 cyl)			A	Arc.	A	Arc.	A	A	A	A
" (6 cyl)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Autocar (2 cyl)	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Avery			A	A	A	A	A	A	A	A
" (Mod. 3A C ton)			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Briscoe	A	Arc.	A	Arc.	A	Arc.	A	Arc.		
" (8 cyl)			A	A						
Buick	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
Cadillac							Arc.	Arc.	Arc.	Arc.
" (8 cyl)	A	A	A	A	Arc.	Arc.				
Case	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Chalmers			Arc.	Arc.	Arc.	Arc.	A	A	Arc.	Arc.
" (Mod. 6-40)			A	Arc.						
" (Mod. 6-30)	A	A	A	A						
Chandler Six	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Chevrolet	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.	A	A
Cole			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (8 cyl)	A	A	A	A	A	A				
Cunningham					Arc.	Arc.	Arc.	Arc.	A	A
" (8 cyl)	A	A	A	A						
Daniels (8 cyl)	A	A	A	A						
Dart	A	Arc.	A	Arc.	Arc.	Arc.	A	A	A	Arc.
" (Mod. C)	A	Arc.	A	Arc.	A	Arc.	A	A		
Delaunay-Belleville					B	A	B	A	B	A
Detroiter	Arc.	Arc.	Arc.	Arc.	A	Arc.	A	A	A	Arc.
" (8 cyl)					Arc.	Arc.				
Dodge	A	Arc.	A	Arc.	E	E				
Dort	A	Arc.	A	Arc.	A	Arc.				
Empire (4 cyl)	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (6 cyl)	Arc.	Arc.	Arc.	Arc.						
Federal	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Fiat	E	A	E	A	E	A	E	A	E	A
Ford	E	E	E	E	E	E	E	E	E	E
Franklin	A	A	A	Arc.	A	A	A	Arc.	A	Arc.
Grant	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.		
H. A. L.	A	A	A	A						
Haynes	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" (12 cyl)	A	A	A	A						
Hollier (8 cyl)			A	A	A	A				
Hudson			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
" (Super Six)	A	Arc.	A	E						
Hupmobile	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Jeffery	A	Arc.	A	Arc.	A	Arc.	A	A		
" (Chesterfield)			A	Arc.	A	Arc.				
" Com'l	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Jordan	Arc.	Arc.								
Kearns			E	E	E	E				
" Com'l	A	Arc.	A	Arc.	A	Arc.				
Kelly Springfield	A	A	A	A	A	A	A	Arc.	Arc.	Arc.
King					A	Arc.	A	A	A	E
" (8 cyl)	A	A	A	A	Arc.	Arc.				
" Com'l	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Kissel Kar	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
" Com'l	A	Arc.	A	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
" (Mod. 46)			A	A	A	A	A			
Lexington	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.				
Liberty (Detroit)	Arc.	Arc.								
Leppard Stewart	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (Mod. M)	A	Arc.	A	Arc.						
Locomobile	E	E	E	E	E	E	E	E	Arc.	Arc.
Marion Handley	Arc.	Arc.								
" (Mod 6-40)	A	Arc.								
Marmon	A	A	A	A	A	Arc.	A	Arc.	A	Arc.
Maxwell	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Mercer	A	A	A	A	Arc.	Arc.	A	Arc.	A	Arc.
" (22-70)					Arc.	Arc.				
Mitchell	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Mitchell (8 cyl)			A	A						
Moline									A	Arc.
" Knight	A	A	A	A	A	A	A			
Moon (4 cyl)					Arc.	Arc.	A	Arc.	Arc.	Arc.
" (6 cyl)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Murray (8 cyl)	A	A								
National	Arc.	Arc.	A	Arc.	A	Arc.	A	A	A	A
" (12 cyl)	A	A	A	A						
Oakland	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
" (8 cyl)			A	A						
Oldsmobile			Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (8 cyl)	A	A	A	A						
Overland	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Owen Magnetic	A	Arc.	A	Arc.	A	Arc.				
Packard					A	Arc.	A	Arc.	Arc.	Arc.
" (12 cyl)	A	A	A	A						
" Com'l	A	A	A	A	A	A	Arc.	Arc.	Arc.	Arc.
Paige					Arc.	Arc.	A	A	A	E
" (6-46)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.				
" (6-36 & 39)	A	Arc.	A	Arc.	A	Arc.				
Pathfinder	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc
" (12 cyl)	A	A	A	A						
Peerless	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (8 cyl)	A	A	A	A						
Pierce Arrow	A	Arc.	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" Com'l	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Premier			A	Arc.	A	Arc.	A	Arc.	A	Arc.
Pullman	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Regal	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
" (6 cyl)	A	A	A	A	Arc.	Arc.				
Renault			A	Arc.	A	Arc.	A	Arc.	A	Arc.
Reo	A	Arc.	A	Arc.	A	Arc.	A	Arc.	A	Arc.
Richmond	Arc.	Arc.	Arc.	Arc.	A	Arc.	A	Arc.	Arc.	Arc.
Riker	E	E								
Saxon	E	E	E	E	E	E	E	E		
Scripps-Booth (air)							B	A		
" (water)	A	Arc.	A	Arc.	E	E				
" (8 cyl)	A	A	A	A						
Seldon	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Simplex	A	A	A	A	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Stearns Knight	A	A	B	A	B	A	B	A	A	A
" (2 cyl)	A	A	B	A						
Sterling (Waconian)	A	Arc.	A							
Studebaker	A	A	A	Arc.	Arc.	Arc.	A	Arc.	A	Arc.
Stutz	A	A	A	A	A	A	A	A	Arc.	Arc.
Velie (4 cyl)					A	Arc.	A	Arc.	A	Arc.
" (6 cyl)	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.		
Westcott	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	A	Arc.
White	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.
Willys-Knight	A	A	B	A	B	A	A	A		
Willys Six	Arc.	Arc.								
Winton	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.	Arc.

Electric Vehicles: For motor bearings and enclosed chains, use Gargoyle Mobiloil "A" the year 'round. For open chains and differential, use Gargoyle Mobiloil "C" the year 'round.

Exception: For *winter lubrication* of pleasure cars, use Gargoyle Mobiloil "Arctic" for worm drive and Gargoyle Mobiloil "A" for bevel gear drive.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of SCIENTIFIC AMERICAN.

Pertaining to Apparel

MONOGRAM ATTACHMENT FOR WATCH FOBS, BELTS, AND THE LIKE.—L. FREEDMAN, 1222 Boston Road, Bronx, N. Y. This invention provides a monogram attachment for watch fobs, belts, suspenders and similar articles and arranged to enable the dealer in articles of this kind to readily assemble the letters for a desired monogram and to attach the monogram to the article selected by the customer.

COMBINATION SUIT.—W. K. JONES, 1503 N Holyoke St., Wichita, Kan. The invention provides a suit combining in one garment overalls or trousers with a jacket or coat, and arranged to provide a back drop flap having a suspender connection with the back of the jacket to hold the flap up to allow of opening the same for sanitary purposes, and to divide the strain on the shoulders and the center of the back and allowing perfect freedom of the body and legs of the weaver.

FASTENER.—G. MULLER, 40 Beverly Road, Ridgewood, N. J. The inventor provides a fastener capable of being safely used on gloves and other articles, even if the latter are made of very delicate materials, and arranged to permit the user to conveniently close or open the fastener without danger of tearing the materials to which the fastener materials are attached.

WATERPROOF BAG FOR BATHERS.—J. J. BLUMBERG, 381 Main St., Worcester, Mass. This improvement has particular reference to bags or similar containers adapted to be worn by bathers, either men or women, wherein articles, such as smoking appliances, toilet articles or the like, may be carried in a dry or waterproof condition even though the owner may otherwise be thoroughly wet from the surf or otherwise.

Pertaining to Aviation

PROPELLER.—E. J. LOWE, 699 8th Ave., New York, N. Y. This invention provides a propeller adapted for use on aeroplanes, which has a flange extending forwardly of the forward edge of the propeller blade, the blade being concave longitudinally and transversely, and ribs being provided at the convex face of the blade to stiffen the latter.

Electrical Devices

PULL SWITCH FOR ELECTRIC MINE SIGNALS.—C. CLAUSEN, P. O. Box, 597, Bisbee, Ariz. This invention improves and simplifies the construction and operation of pull switches so as to be reliable and efficient in use, comparatively inexpensive to manufacture, and so designed that it will positively automatically open when the pull for closing the switch is released.

ELECTRIC VALVE GRINDER.—H. C. NEWMAN, 205 W. 48th St., Los Angeles, Cal. The inventor provides a valve grinder so designed as to automatically impart a partial turn to the valve while the same is seated, lift the valve and impart a shorter backward turn while the valve is lifted, and indefinitely repeat its cycle until the valve is properly ground and the tool removed.

Of Interest to Farmers

GRAIN STOREHOUSE CONSTRUCTION.—LIZZIE H. DICKELMAN, care of Dickelman Mfg. Co., Forest, Ohio. An object of this improvement is to provide a structure which is substantially all metal, the construction being primarily designed as a corn crib in which perfect ventilation is secured, while at the same time the contents of the crib are kept from snow and rain. The device is vermin proof and rat proof.

BALE TIE BUCKLE.—E. A. FRANTZ, Weatherford, Tex. The invention provides a buckle made of a single length of wire which has the advantage that the bale band may be reeved through the buckle and can be drawn up tight around the bale before the pressure on the bale is released. This buckle eliminates the creeping of the bale band that usually occurs with the ordinary wire buckle.

AUTOMATIC HEN'S NEST.—J. E. DRAKE, Blue Rapids, Kan. This improvement provides an automatic nest having entrance and exit runways and automatic alley operating means for maintaining one of them closed while the other is open, said means acting to prevent admission to the next through either runway while the nest is occupied.

HOG YOKE.—A. H. BRIDWELL, Beech Grove, Ky. This inventor provides a neck yoke for animals, particularly swine, to prevent the animals from forcing or burrowing their way through fences or other similar structures, novel features for adjusting the device in placing the same in use and for maintaining the equilibrium of the device whereby to return it to proper position after displacement caused by wallowing or rolling of the animal, being involved in the construction.

Of General Interest

PROCESS FOR TREATING FRESH MEATS WITH A VIEW TO CONSERVE THE SAME IN A FRESH CONDITION IN OPEN AIR.—J. J. MONVOISIN, 40 Rue Jules Ferry, Montreuil, Paris, France. The process essentially consists: first, in superficially sterilizing the meat by chemical or physical means, as soon as the animal is slaughtered; secondly, in subjecting the so superficially sterilized meat to a vacuum and at the lowest temperature possible, in order to rapidly cool the said meat and, if necessary, eliminate the product means employed for the initial sterilization; thirdly, in moistening the superficial portion of meat on its leaving the vacuum apparatus; fourthly, in afterwards drying the meat in a current of dry and sterile hot air.

COMBINED UMBRELLA AND TENT.—G. W. BARRINGER, Lawrence, L. I., N. Y. This invention relates to tents and particularly to a combined tent and umbrella, and has for an object the provision of an improved arrangement whereby the device may be used so as to present merely an umbrella structure, or may be rearranged and produces a complete tent construction.

MAILING CARTON.—F. E. UTTMARK, 101 Columbia Heights, Brooklyn, N. Y. The invention provides a resilient frame for absorbing blows incident to traffic, which otherwise would be imparted to the contents of the carton; provides spiral wire frame adapted to be collapsed within confined limits; provides a top covering to form a hinge member in conjunction with one of the convolutions of the wire frame; forms integrally with the said cover, a guiding latch head; provides a fabric covering for the said frame; and provides a mechanical fastening for the temporarily closed end and means integrally formed with said cover for operating as an address tag.

PROCESS OF FLAVORING TOBACCO.—W. A. PARKER care of Dan. E. Parker, Bedford City, Va. The invention improves the process of preparing tobacco for consumption without the necessity of any manufacturing process after the tobacco leaf is cured, this advantage being attained by applying the sweetening or flavoring material to the leaf of the standing plant or while the leaf is in a natural state and growing.

PACKAGE SEALER AND FASTENER.—H. C. MARSTON, 173 Murray Ave., Goshen, N. Y. This invention has for its general objects to provide a comparatively simple and inexpensive sealing and fastening device which is reliable and efficient in use, easy and convenient to apply, and so designed that a tie string can be easily and quickly secured to the device whenever a tie string is required.

Hardware and Tools

DEVICE FOR PICKING UP AND DROPPING LUMP SUGAR AND CANDY.—A. MENDELSON, 482 Marcy Ave., Brooklyn, N. Y. The object here is to provide a conveniently operable device which takes the form of a clasp or pair of tweezers capable of operation by one hand the device being such as to permit it to be readily wedged into a bowl or box containing sugar or candy without interference or binding obstruction as would be the case in the use of ordinary tongs or ice-pick-like devices.

GEAR DRAWING INSTRUMENT.—C. H. SAPPER, General Delivery, Norfolk, Va. The invention provides an instrument for drawing gears which may be adjusted for drawing gears with any desired number of teeth and of any pitch diameter. The instrument may be operated to trace the shape of the teeth over a master ring, and by means provided, move a pen over paper to draw the gear teeth thereon, the said means being adjustable to draw the gear of the desired diameter and the teeth of the desired depth.

KEY RING.—M. SAPO, 40 W. 40th St., New York, N. Y. In the present patent the invention has reference to a key ring. The object thereof is to provide a simple, strong and efficient ring which cannot open accidentally and which can be easily and quickly manipulated to place upon or remove therefrom a key.

Heating and Lighting

LIGHT CUT-OUT SWITCH FOR FIRE HOUSES.—J. GROUSS, 9 Baltic St., Elizabeth, N. J. It is the general object of the present invention to improve automatic cut-out apparatus whereby the lights will remain cut out after the first alarm and until the apparatus is reset, when the members of the fire company return to the fire house.

FLASH LIGHT HOLDER.—E. E. THULIN, Northwood, N. D. The invention relates to lamp or lantern holders and has particular reference to means for securing a flash lamp to a person's body so that the light from the lamp may always be available when and where needed without interfering with the free use of the person's hands.

Household Utilities

COAL HOD.—R. L. CLARK, Union, W. Va. The general objects of the improvement is to provide a coal hod equipped with a guard attachment arranged to be moved to a position above the upper edge of the hod to prevent the spelling of the coal over the sides of the hod when discharging the coal directly from the hod into a stove, furnace or the like.

VACUUM CLEANER.—H. L. PETERS, 462 McKinley Ave., Salem, Ohio. This invention provides a vacuum cleaner having a plurality of nozzles or suction heads independently connectable by a valve with suction-producing means, whereby any one device may be used, one of the nozzles being in the form of a handle which, when not used as a nozzle, serves to move the vacuum cleaner over the floor or surface being cleaned.

MEANS FOR ADJUSTING VENTILATING CLOSURES.—E. LLEWELLYN, Tanybryn, Ystrad, Rhondda, Wales. The improvement refers to adjusting means for ventilating closures such for example, as skylights, fanlights, ventilators, and windows of the type comprising an adjustment bar secured to the movable member of the window or the like, and a spring-controlled detent carried by the fixed member and adapted to engage one or the other of a series of apertures in the adjustment bar.

REFRIGERATOR.—C. M. GRAHAM, 941 Normal Ave., Tempe, Ariz. The invention provides a refrigerator wherein an ice receiving chamber and a series of food receiving chambers are provided, so arranged that the air will circulate down through the ice chamber to be cooled and will pass around the food receiving chambers

(*Continued on page 404*)

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LIBRARY AND COLLECTIONS of the late Professor Lechmere Guppy, F.L.S., F.G.S., C.M.Z.S., etc.—over 800 Scientific Books, complete sets P.Z.S. from 1875 to 1914, Geological from 1860, Conchological from 1850, Palæontological and other similar publications. Over 4,000 species Fluviatile, Terrestrial and Marine Molluska from West Indies and other parts of the world. Over 1500 slides Foraminifera—collections named, classified and catalogued. Apply Guppy, Port of Spain, Trinidad, B.W. I., for further particulars.

FOR SALE

RECENTLY PATENTED ROTATING GASOLINE ENGINE, built along new lines; gas saving, light weight proportionally to power produced; fully tested. N. J. Paddock, Cortland, N. Y.

BUSINESS OPPORTUNITY

EXTRAORDINARY OPPORTUNITY for Investor in two patent articles; the greatest inventions of the age in kitchen articles. Millions in them. First time offered. On account of age, I offer them for sale. Curiosity seekers keep your stamps. For further particulars, address John W. Brown, Lock Box No. 1321, Washington, D. C.

BUSINESS OPPORTUNITIES

INVENTORS AND PATENTEES of Oil and Solid Burning Engines desiring to have same manufactured, communicate with Post Office Box 197, Wapakoneta, Ohio.

BUSINESS OPPORTUNITY

EXPERIMENTAL LOFT.—Moderate size and price. Lighted all around. Especially adapted for developing the manufacture of machinery. Ample electric power. Call 56 Pearl Street, corner of Water Street, Brooklyn. Mr. Coon, engineer, will show the loft.

AGENTS WANTED

AGENTS. 500% Profit. Free Sample Gold and Silver Sign Letters for store fronts and office windows. Any one can put on. Big demand everywhere. Write today for liberal offer to agents. Metallic Letter Co., 436 N. Clark Street, Chicago, U. S. A.

WELDING

DON'T SCRAP ALUMINUM PARTS. So-Luminum, new welding compound, repairs aluminum in one-half time and cost acetylene welding. Use gasoline torch—no flux. Trial bar 50c; **$3.00 per pound.** Money refunded if not satisfactory. So-Luminum Mfg. & Eng. Co., Inc., Dept. A., 1790 Broadway, New York City.

HELP WANTED

INSTRUMENT MAKERS wanted for military and other optical instruments; steady position, liberal wages. State age, experience and references. Instrument, Box 773, New York City.

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Indiana, Terre Haute
ROSE POLYTECHNIC INSTITUTE
A College of Engineering. Courses in Mechanical, Electrical, Civil, Chemical and Architectural Engineering. Extensive shops and laboratories, expenses low. 74th year. For catalog, information and professional register of alumni, address F. L. Mees, President.

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Grand Book Catalog. Over 700 engravings 25c. Parlor Tricks Catalog Free.
MARTINKA & CO., Manufacturers, 493 Sixth Avenue, New York

LEPAGE'S GLUE HANDY BOTTLES
STRONGER THAN NAILS 10¢

National Tennis Tapes
GALVANIZED IRON
TOP FINISH WITH SURFACE
PERMANENT MARKING
SAMPLE FREE
LORD MFG. CO. 108 W. 40th ST. N.Y.

American Hardware in Foreign Markets

(*Concluded from page 393*)

in competition with European makers. My point is that we have done so well in some lines that it is reasonable to expect that we shall eventually do better in many more. European cutlery still more than holds its own everywhere. Our safety razors are the universal standard, but European makes of the old-fashioned razors still have the call. We lose some sales because we do not use the metric system when foreign customers wish it. In some South American countries the houses are designed by Paris-trained architects and will be for many years to come. The hardware for these buildings is of French design, and the orders do not come to us. Probably we could get them catering to the wishes of the architects, and we ought to do it in cases of that kind. Our sales of kitchen utensils to foreign countries are not extensive, and there are a number of other lines in which we do not do so well as some of our competitors.

But the thing to be borne in mind is that we are doing a great foreign business in hardware and doing it on merit. We can look forward to a constantly increasing business because we are going along on an absolutely sound basis. And eventually it will mean a much greater business in many lines right at home, for, odd as it may seem, Americans are more reluctant to recognize the excellence of our own products than are the foreign consumers. Many of our fellow citizens will not buy American goods unless they are lower priced than the imported articles. They labor under the delusion, based on the experiences of other generations, that where quality is the first consideration, imported goods are the most desirable. There are Americans, I image, who would today willingly pay more for an imported imitation of an American safety razor than they would for the best American makes. I wish such people could be made to understand the reputation of our hardware even in the hardware-manufacturing countries of Europe. It would not only be a fine thing for the domestic hardware trade, but would undoubtedly have a favorable effect on many other lines.

Recent Chemical Developments

(*Concluded from page 391*)

with nitroglycerin Mr. Sadtler obtains a nitro-starch explosive and he offers certain comparisons with dynamite which are interesting. He gives the following:

Disadvantage of dynamite: Dangerous under shock, injurious fumes, sensitive to temperature, high cost.

Disadvantages of nitro-starch: Not plastic although it can be made so, more bulky than dynamite and inert when wet.

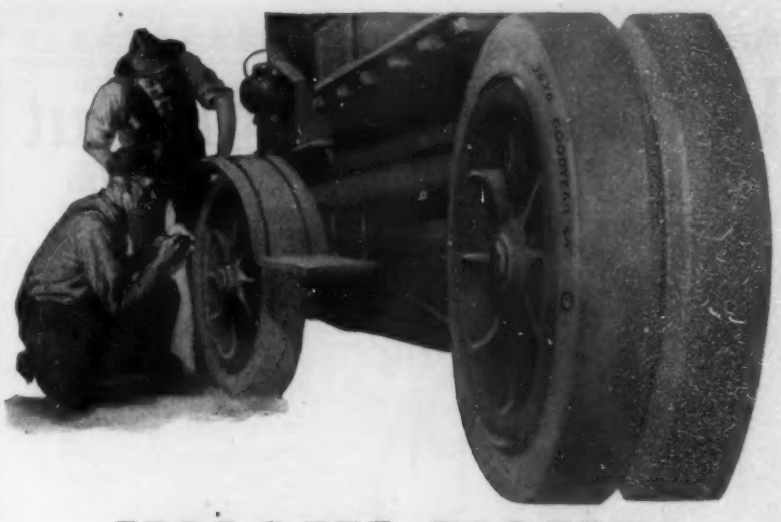
Advantages of dynamite: Compact, plastic, users are familiar with it, is not affected by dampness and is thoroughly stable.

Advantages of nitro-starch: Not sensitive to shock, apparently of good stability, has wide range of usefulness, emits no injurious fumes, and is not sensitive to changes of temperature. It is cheapest of all the high explosives.

Nitro-starch has also an important possible field in military and naval use. It is likely to come along pretty soon. Maybe not right away, but soon.

In the development of chemical industry in France some odd hindrances have been met in certain ancient laws that still remain on the books. They date back to 1777 and regard chemists as engaging in black magic and necromancy. These provisions are designed to protect the general public against their devilish practices.

In Switzerland license has been granted to the Lonza Electric Company to make alcohol from calcium carbide and the erection of a plant is contemplated costing 9,000,000 francs. The primary object is to produce alcohol for industrial purposes, but it is possible to make drinking spirit by the same process. The works will be built at Visp.



KNOW YOUR TRUCK TIRE COSTS

Some business men know where every pencil goes, and save the stubs, but still operate fleets of motor trucks *not* equipped with odometers.

Mileage, therefore, is not measured and they have no accurate basis for figuring cartage costs.

The trifling expense of the recording device is saved and all exact knowledge of truck operation is lost.

We urge executives in all lines of business to remedy this condition, to install accurate cost systems in their trucking service, based on the sound truth of odometer records.

We urge this in self-protection, knowing that where such records are kept, the superior economy and service of Goodyear S-V Pressed-On Truck Tires must be proved.

Men who keep such records send us astounding accounts of S-V performance—mileages exceeding 40,000 in strenuous city bus service, and more than 20,000 on rough country routes.

Having no direct interest in the sale of odometers we urge *you* to buy one of these inexpensive, truth-telling instruments for each truck you have in service.

Because this will be your first step toward standardizing on S-V as your truck tire equipment.

The Goodyear Tire & Rubber Company
Akron, Ohio

S-V FIRST

GOODYEAR
AKRON

Richmond Straight Cut
CIGARETTES *Plain or Cork Tip*

"... even the sophomores treated me with some respect when I produced the Virginia cigarettes which I'd brought up from Richmond."

That fine old Southern Aristocrat—"Richmond Straight Cuts." There's never been another cigarette quite like them. Their "bright" Virginia tobacco has a naturally refreshing flavor that makes even the best of Turkish cigarettes taste almost tame and characterless by contrast. You'll wish you'd tried them before.

Also packed in attractive tins, 50 for 40 cents; 100 for 75 cents. Sent prepaid if your dealer cannot supply you.

Allen & Ginter RICHMOND, Virginia, U.S.A. Successors to ALLEN & GINTER LIGGETT & MYERS TOBACCO CO.

15c

NOTE: Unlike Turkish tobacco, Virginia tobacco pays no import duty—all the value in Richmond Straight Cut cigarettes is in their choice Virginia tobacco.

PREFERRED by GENTLEMEN NOW as THEN

HERCULES
Smokeless Shotgun POWDERS

At this end of the shell is the name of the powder. Ask for and look for

INFALLIBLE

or "E. C."

Know Your Shotgun Shells

YOU can't know too much about the shells you shoot. The information you should have is easy to obtain for it is told on the shell itself. The two ends give the story.

On the base you will of course find the name of the maker and the loader of the shell, and the gauge. At the other end, on the top wad, are printed the size and quantity of shot, the quantity of powder and, last but not least—*the name of the powder.*

Hercules Smokeless Shotgun Powders, Infallible and "E. C.", may be obtained in any standard make of shell. Undoubtedly the name of the maker of your favorite shell is given in the column to the right.

The next time you order shotgun shells it will pay you to see that they are loaded with Infallible or "E. C." Powder. By so doing you will obtain a powder of the highest quality and of uniform quality—a powder that gives unusually light recoil, high velocity, and even patterns. You will find the name of the powder stenciled on the outside of the box, as well as on the top wad.

For a booklet on ammunition, of interest to any sportsman, address

HERCULES POWDER CO.
1033 Market Street
Wilmington Delaware

On this end is the name of the maker. Hercules Smokeless Shotgun Powders may be obtained in shells made by the following:

PETERS
REMINGTON
SELBY
U. S.
WESTERN
WINCHESTER

RECENTLY PATENTED INVENTIONS

(Concluded from page 402)

to absorb the heat from the material to be refrigerated and will again pass upward to be again cooled, thus providing a continuous circulation through the refrigerator and about the ice and the material to be refrigerated.

Machines and Mechanical Devices

MAGAZINE FOR LABELING AND STRAPPING MACHINES.—C. BECKMANN, care of E. D. Anderson, 81 6th St., Long Island City, N. Y. The invention provides a magazine in which the pack of labels or wrappers is held with the labels or wrappers vertical, and the outermost label or wrapper is picked up and removed from the magazine in a vertical plane, there being novel means cooperating with the pick-up elements for insuring the delivery of the labels in a uniform manner and one at a time.

CARTON UPSETTING DEVICE.—C. BECKMANN, care of E. D. Anderson, 81 6th St., Long Island City, N. Y. This invention relates to a device for upsetting or opening cartons preparatory to the receiving of the contents of the carton and constituting an essential part of a cartoning machine. The invention has for its general objects to provide a device which is reliable and efficient in use, and so designed as to operate at a comparatively high speed.

CENTRIFUGAL PRESSURE FILTER.—F. K. ATKINS AND E. F. ATKINS, care of T. Shriver & Co., Harrison, N. J. The invention relates to filters of that type in which the filter elements rotate within a body of liquid to be filtered that is contained in a vessel to which the liquid is supplied under pressure, the rotating filtering elements causing the liquid to acquire a centrifugal motion whereby the solid particles are thrown outwardly against the surrounding wall of the chamber on which the said particles collect and flow by gravity to a suitable point of discharge.

Musical Devices

MUSIC LEAF TURNER.—H. J. BAILEY, Dickenson St. and N. Alden Ave., Trenton, N. J. This invention has particular reference to devices for holding and automatically turning the leaves of sheet music. The construction is adapted to be secured either upon a music rack of ordinary nature or upon a piano casing or other stationary support. The invention also provides a means which will hold the music leaves securely and yet not damage the same.

REPEATER FOR TALKING MACHINES.—J. PARA, 550 South Park St., Elizabeth, N. J. The invention automatically replaces the recording needle at the beginning of a record groove of a record disk; automatically controls the number of repetitions and the operation of the mechanism effecting the same; sets the mechanism to a point where it is intended that the repetition should be inaugurated; and avoids discordant, harsh, or violent sounds when disengaging the needle from and when engaging it with the record disk.

Prime Movers and Their Accessories

ROTARY ENGINE.—E. M. LONG, Oak City, N. C. An object here is to provide an efficient, comparatively non-gyroscopic engine. Another object is to provide a rotary engine of the internal combustion type in which the successive explosions are so frequent that the resulting combustion of the fuel may be said to be continuous. A further object is to provide a rotary engine in which the direct impact of the explosion, as well as the expansion potential of the igniting gas is utilized.

BOILER.—R. F. E. OKRASSA, Antigua, Guatemala. The boiler is arranged without an ash pit within the boiler and is capable of being used for the generation of dry or wet steam as desired. So accomplish this, use is made of a combined hollow superheater and deflector located at the rear end of the shell for directing the products of combustion from the fire box to the return flues and for generating steam in the said superheater and deflector. Use is also made of a tubular fire box arranged within the shell.

Railways and Their Accessories

MAIL BAG DELIVERING APPARATUS.—J. C. BLANTON and D. J. SEXTON, Freeman, W. Va. This invention provides means for transferring mail from a car to a stationary stand at a station or the like, or from such a stand to the car without mutilating the mail or the bag; and provides an apparatus that will deliver a full bag with equal facility and precision as with a bag partly full, and which will deliver two or more bags at one time.

CAR DOOR.—J. H. CRUMB, Platte, S. D. This invention provides a car door in the use of which extra timber now employed in connection with car doors will be dispensed with; provides a car door so formed and mounted as to be clamped, when closed, solidly in place to constitute in effect a continuation of the side of the case, thereby making unnecessary the employment of extra grain doors or linings when loading grain or other material in bulk; and provides a car door so mounted that it will not be clogged by ice or snow.

LOCOMOTIVE DRIVING BOX.—C. F. PRESCOTT, 131 Fort Greene Place, Brooklyn, N. Y. Among the objects here is to provide a journal box made of a plurality of relatively movable parts, certain of said parts being parallel to each other and movable toward each other automatically or otherwise to take up for wear at the front and back portions of the axle.

Pertaining to Recreation

TOY.—T. J. IRWIN, 452 Center St., Trenton, N. J. In this instance the invention relates to the construction of toys, and more particularly to a toy of that type in which said or equivalent granular material feeds into a car to cause the latter to move by gravity from a receiving to a discharging position.

GAME DEVICE.—M. GUSTOV, 417 Claremont Parkway, New York, N. Y. This invention relates to toys and games for children, and provides a device which may be used as a doll or toy, as an effigy of a bear, although it may represent other animals, and which may be used at will as a game device in conjunction with one or more playing balls.

GAME APPARATUS.—H. E. COATES, 2015 Carnegie Ave., Sacramento, Cal. This apparatus has a casing with pivoted arms, one end of the casing having an opening through which a ball may be dropped to roll down against one of the arms, the said arms having signal plates secured to them, so that when an arm is struck by a ball its signal plate will be raised thereby indicating which has been struck. After being moved by the ball, the arm is returned to normal position by a frame which extends across the casing to engage the arms, this frame being held yieldingly out of operative position by a spring, and being adapted to be operated against the resiliency of the spring by means provided.

OIL FILTER.—F. J. ARMSTRONG, Canadian, Tex. This invention effectively separates all foreign substances from oil or other fluid used in automobile engines and the like, and the apparatus includes a tank having an inner casing spaced therefrom and carrying filtering device through which the fluid initially passes. A partition is also mounted within the tank and supports another filter, which projects still into another filter also supported by said partition, the fluid passing through the latter filter after flowing around said inner casing.

Pertaining to Vehicles

ANIMATED ADVERTISING DEVICE FOR CARS.—L. A. MOLTENI, 1032 Hudson St., Hoboken, N. J. This invention has for its principal object the provision of an advertising placard or sign in which the animated or moving element is actuated by the momentum of the vehicle in starting and stopping, and by the vibration while running.

MOTOR CYCLE STAND.—H. W. WEED, 35 Lombardy St., Newark, N. J. This invention has particular reference to stands or means for supporting motorcycles or the like machines in upright position. It provides a supporting stand for a motorcycle carried by and cooperating with the central or power portion there of rather than with the frame at the rear wheel.

WIND-SHIELD CLEANER.—G. D. FLEAK, 918 Wyoming St., San Antonio, Texas. Mr. Fleak's invention is an improvement in wind-shield cleaners, and provides a device of the character specified by means of which a wind-shield may be cleaned from within the auto without the necessity of extending the arm beyond the shelter of the car.

TIRE TOOL.—W. A. KINSOLVING, 201 I St., Washington, D. C. An object here is to provide a device by means of which the removal or replacement of a pneumatic tire may be easily effected. A further object is to provide a simple tool consisting substantially of two parts, which can be instantly assembled and very readily taken apart so as to go into the tool kit.

VEHICLE SPRING SHACKLE.—J. J. CRAWFORD, 304 Jewett St., W. New Brighton, S. I., N. Y. The shackle is more especially designed for use in connection with the leaf springs of automobiles and other vehicles, and is arranged to act as a shock absorber and to guard against breaking of the vehicle springs. Means provides for attaching the spring shackle to the leaf springs and to the front axle or the rear axle housing of the automobile.

AUTOMOBILE SAFETY SIGN.—V. PAVLOFF and Z. ORIZAROFF, 1025 N. 7th St., Harrisburg, Pa. This invention relates to signaling devices and particularly to a signaling device adapted for vehicles, and provides an improved construction operated by the driver for disclosing his intentions in regard to stopping or turning either to persons in front or in rear of the vehicle.

Designs

DESIGN FOR A TOY BANKING-ROOM.—C. L. GLENN, Winston-Salem, N. C. This design comprises attractive architectural features and represents a banking establishment fitted with bookkeeper, teller, president and cashier offices.

DESIGN FOR THE FRAME OF A CHILD'S VEHICLE.—A. T. MANCHESTER, 40 High Service Ave., North Providence, R. I. In this ornamental design for the frame of a child's vehicle the representation discloses a simple, exceedingly graceful and well-balanced form of vehicle accessory.

DESIGN FOR AN AUTOMOBILE RADIATOR.—C. T. SILVER, care of J. M. Lowenstein, 149 Broadway, New York, N. Y. In this ornamental design for an automobile radiator the article is effectively represented by a front view, a side elevation and a plan view of the auto accessory.

DESIGN FOR A BUTTON, BADGE, OR SIMILAR ARTICLE.—J. A. BERCHTOLD, Sigel, Ill. This ornamental design for a button, badge or similar article represents a bird in flight, with a twig of leaves in its bill and a smoking pipe in its claws.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of patentee, title of the invention, and date of this paper.

SIMONDS
The Scientific American
is particular about the quality of his tools—Nothing but a
SIMONDS SAW
has a chance with him because its 86-year-old reputation is a guarantee of consistent performance.
Along with the development of saws we have developed in our own mills the making of edge-holding crucible steel—that's why we are sure of our saw quality now. Do you own a Simonds Saw?
"The Professor and the Saw" is one of our interesting story books on Saws which we will send free on request.
Simonds Manufacturing Company
The Saw Makers
Established 1832
Fitchburg, Mass.
Five Factories—Eleven Branches
"I Tell You It's A Great Saw"

Electric Row Boat Motor

Make your Row Boat an Electric Launch. Buy a Jewel Detachable Row Boat Motor run by electricity. No odor or dangerous gasoline. Simple, noiseless and powerful. Attaches to any Row Boat and runs on two six volt Batteries. This is our 5th successful season.

Open Window Battery

Look inside your storage battery through the patented open window. See condition of plates and height of electrolyte. If you need a new automobile starting Battery buy a Jewel and save money.

6-60 Special $8.50.

MOTORCYCLE ELECTRIC LIGHTING SYSTEM

The Jewel Generator Motorcycle Storage Battery and complete lighting system is in great demand.

Agents wanted. Write for prices and catalog M.B.

JEWEL ELECTRIC COMPANY, 152 S. Fifth Ave., Chicago

Run by Electricity

ICE MACHINES Corliss Engines, Brewers and Bottlers' Machinery.

The VILTER MFG. CO.

899 Clinton Street *Milwaukee, Wis.*

Does Away With Hand Feeding

Friction and Ratchet Feeds

No. 1005

With the "YANKEE" Bench Drill you simply turn the crank: Friction feed moves drill to the work; then, "YANKEE" Ratchet Movement feeds the drill.

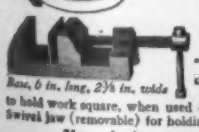
Ratchet thrown off automatically, top or bottom; no jamming. Positive, fixed feed avoids breaking drills. No skill needed.

"YANKEE" TOOLS

Made Better Mechanics

No. 1005—Two speeds; 3-jaw chuck holds up to ½-inch. Price, $16.50 (in Philadelphia).

No. 1003—One speed; 3-jaw chuck holds up to ¼-inch. Price, $10.00 (in Philadelphia).



"YANKEE" Vise No. 890

Designed for use on "Yankee" Bench Drills or attached to bench.

Base, 6 in. long, 2½ in. wide

Accurately machined to hold work square, when used either flat or on sides. Swivel jaw (removable) for holding taper work. **$2.20**

Your dealer can supply you

Write us for "'Yankee' Tool Book," showing Bench, Chain, Breast and Hand Drills with "Yankee" Ratchet Movement

NORTH BROS. MFG. CO. Philadelphia

Insect Depredations in Wood

DAMAGE amounting to hundreds of thousands of dollars annually is done by beetle larvæ to seasoned wood about the home and farm, or stored in warehouses. These tiny creatures bore through the wood and convert it into a fine powder, greatly lessening the strength of the mass. Greatest damage is done to second-growth white wood or sapwood of the finest quality of hardwoods, especially hickory, ash, and oak, which has been stored or piled in one place for two or three years. Other woods, however, either while stored or after being made into various articles, are often attacked, especially when they are associated with the woods more susceptible to attack. Sapwood seasoned for less than eight to ten months is not attacked by the insects, and heartwood is never attacked.

The beetles whose grub cause the damage are known to science as the Lyctus beetles. Four species are responsible for most of the losses. The beetles are small, slender, somewhat flattened, and are of a brownish to nearly black color. Upon emerging from the wood where they breed and pass the winter as larvæ they fly or crawl about in search of suitable wood material in which to deposit their eggs. The eggs are deposited in the natural pores of the wood, and the minute larvæ which hatch from them burrow in and through the wood in all directions, feeding and growing as they proceed. The full-grown larvæ are yellowish white grubs ranging in length from one-eighth to one-fifth of an inch.

The presence of the beetles in dwellings usually may be detected by the occurrence of fine floury wood powder at the base of the wood which has been attacked. Among the articles which the beetles are known to have infested are interior finish or trim, and ornamental woodwork such as panels, mantels, doors, doorposts, staircases, wainscoting, flooring, etc., furniture, filing cases, cabinet work, walking sticks, umbrella handles, and the handles of numerous tools and implements. In the case of furniture and cabinet work, the sapwood portions of backs and interior surfaces are most liable to attack.

As a measure of prevention the wood likely to be attacked may be treated with boiled linseed oil or coats of paraffin or varnish. Kerosene or mixtures of kerosene and creosote may be applied to infested woods to kill the grubs. In storehouses more extensive measures of treatment may be employed both for preventing the attacks and killing the grubs in the wood. Manufacturers of and dealers in stocks of susceptible woods will find it especially advantageous to adopt the means of protection outlined in Farmers' Bulletin 778, recently published by the United States Department of Agriculture, and which goes thoroughly into the theory and practice of the matter.

What Shall We Do to Prevent Our Enormous Forest-Fire Losses

THE creation of an active public sentiment that will not tolerate fires in the woods any more than in towns and cities, is the remedy for our enormous annual losses by forest fires, according to Prof. Ralph S. Hosmer of Cornell, speaking at Ithaca recently before farmers' week visitors at the State College of Agriculture. The prevention of forest fires is the first step in the proper management of any tract of woodland, he claimed, and with proper organization the loss from fire in the forests can be reduced to the same basis as the losses in towns.

The direct annual fire loss in the United States from forest fires is said to be about $5,000,000 to which must be added an equal amount from the destruction of sawmills, farm buildings, crops, and stock that are burned by fires originating in the forests. Apart from the property loss there is an average death list of seventy human lives each year. The indirect losses through the destruction of raw material, the shutting down of sawmills and wood-working industries, the losses in wages through unemployment, all tend to increase the price of wood products, and

(Concluded on page 408)

$1150 F.o.b. Racine
Mitchell Junior—a 40 h.p. Six 120-inch Wheelbase

$1460 F.o.b. Racine
7-Passenger—48 Horsepower 127-inch Wheelbase

Mitchell SIXES

The Extra Features

You will find in the Mitchell 31 features which nearly all cars omit. On this year's output they will cost us about $4,000,000.

They are paid for by factory savings, due to John W. Bate. He has spent millions of dollars and years of time to minimize our factory cost.

He built and equipped this mammoth plant to build this one type economically. For less than anyone else could build it. The results show in these extra values, which we ask you to see.

The Extra Beauty

This year we occupy our new body plant. By applying Mr. Bate's methods it affords another big saving. Out of that saving we add 24 per cent to the cost of finish, upholstery and trimming.

See the new, enduring finish that results. See the extra-grade leather, the deep cushion springs, the light in the tonneau, the locked compartment, etc.

See the new-style bodies, each a Mitchell creation. Our experts examined 257 models before designing these.

The Extra Strength

In the past three years we have doubled our margins of safety. The present Mitchell standard is 100 per cent over-strength in every vital part.

Over 440 parts are built of toughened steel. All safety parts are vastly oversize. We use a wealth of Chrome-Vanadium steel.

The result, we believe, is a lifetime car. We have proved that Mitchells can run over 200,000 miles.

Go see the results. See them in Mitchell Junior—our amazing $1150 Six. See them in the larger Mitchell, combining every known attraction. You will find no values like them in fine cars.

TWO SIZES

Mitchell—a 7-passenger Six with 127-inch wheelbase and a highly-developed 48-horsepower motor. 31 extra features.

Price $1460, f. o. b. Racine

Mitchell Junior—a 5-passenger Six with 120-inch wheelbase and a 40-horsepower motor. 26 extra features.

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Also six styles of enclosed and convertible bodies. Also new Club Roadster.

MITCHELL MOTORS COMPANY, Inc.
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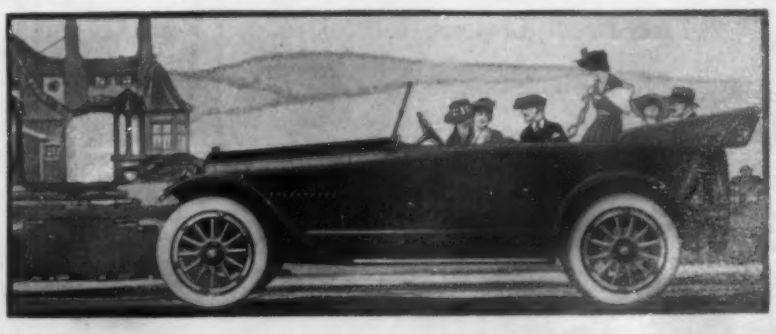
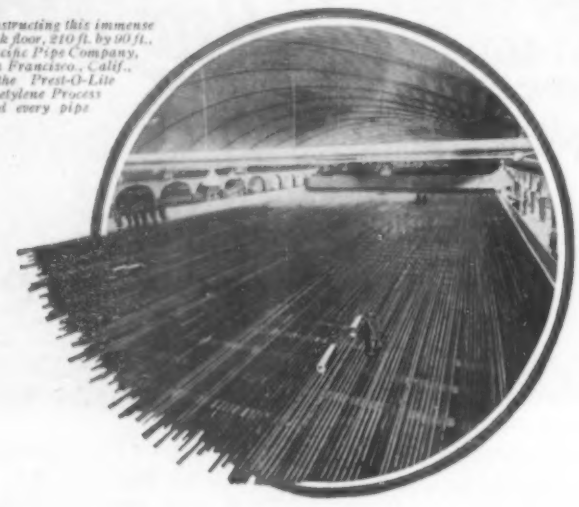


Oxy-Acetylene Welding and Cutting



In constructing this immense ice rink floor, 210 ft. by 90 ft., the Pacific Pipe Company, of San Francisco, Calif., used the Prest-O-Lite oxy-acetylene Process to weld every pipe joint.

Ten miles of pipe and every joint leak-proof

This maze of 2-inch ammonia pipe forms the floor of the immense Winter Garden Ice Rink, in San Francisco. With oxy-acetylene welding all joints (more than 2,000 in all) were made permanently leak-proof, and a substantial reduction was made in the cost of installation.

Prest-O-Lite welding has become standard practice on steel pipe-lines and is widely used in constructing piping systems for steam, gas or air—in office buildings, hotels, factories, power plants and refrigerating installations.

The welded joint is as strong as the pipe itself, saves valuable space and is neater. It effects substantial savings in simple installations as compared with the use of threaded couplings and where special fittings would ordinarily be required welding makes even greater savings.

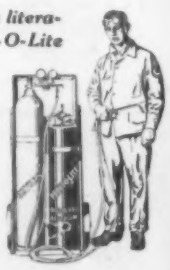
It will pay you to know the possibilities and savings oxy-acetylene welding has for your plant.

Prest-O-Lite PROCESS

Employs both gases (acetylene and oxygen) in portable cylinders. Prest-O-Lite Dissolved Acetylene (ready-made carbide gas) is backed by Prest-O-Lite Service, which insures prompt exchange of full cylinders for empty ones. Provides dry purified gas, insuring better welds, quicker work, and lower cost, and also avoids the large initial outlay and heavy depreciation incurred in making crude acetylene in a carbide generator.

Necessary equipment is not expensive. We furnish high-grade welding apparatus for $75 (Canada $100); acetylene service at additional cost. Adaptable for oxy-acetylene cutting by the addition of special cutting blow-pipe. Thorough instructions are furnished free to every user of Prest-O-Lite Dissolved Acetylene—any average workman who understands metals can learn the process quickly and easily.

Special information on pipe welding together with literature describing hundreds of profitable uses for the Prest-O-Lite Process, gladly sent on request.



The Prest-O-Lite Co., Inc.

U. S. Main Office and Factory, 810 Speedway, Indianapolis
Canadian General Office, Toronto, Ontario

Branches and Charging Plants in all principal industrial centers

World's Largest Makers of Dissolved Acetylene

The Value of Agriculture in Time of War

(*Concluded from page 391*)

in water and exposed in open vats. The production of protein occurs in five hours, and this substance may be fed to animals as a concentrated food.

The food problem in England is of an entirely different nature. In Germany economies are urged and practiced on account of feared shortage, but in England the people are urged to economize on account of high prices. The British, owing to their supremacy at sea, are able to secure the supplies from the neutral nations, especially the United States. Hence, we find the government devoting its energies teaching people how to use food economically and to prevent waste. To do this food demonstrators are being sent all over the country.

All these measures, however, were not sufficient, for on November 15th, 1916, the Board of Trade which is now in control of the food supplies, through its chairman, Mr. Runciman, announced that a "Food Controller" had been appointed, and that the price of milk had been fixed at four cents a quart. Furthermore, it was ordered that wheat should in future be ground to yield 80 per cent flour, instead of 70 per cent as heretofore. This new edict will effect a great saving to the nation. About 600,000 tons more flour will be made available, thus providing for an extra two-pound loaf for each inhabitant of the United Kingdom every three weeks, or 17 such loaves per head of the population per annum.

The English scientists have given considerable attention to the utilization of natural resources. Prof. Bottomley, of the Botanical Department, King's College, London University, asserts that England not only can be made to produce enough grain for home consumption, but can even grow a surplus for export, provided a cheap fertilizer can be obtained. He claims to have discovered the best and cheapest fertilizer known. It is obtained from peat by inoculating with nitrogen-fixing bacteria from leguminous crops.

An artificial milk suitable for both human and animal use has been synthesized. The ingredients are peanuts, soy beans, a sugar, water and the mineral salts found in natural milk. The milk so produced may be condensed or dried to a powder in the usual way. It may be given a cream by the addition of cocoanut or other tasteless fat and boiling longer in the vacuum pan, and it may be cultured differently to give a table cream or a soured mass for churning. The residual meals are mixed, dried to 10 per cent water content, and used as a cattle feed.

England's colonial possessions have been of inestimable value to her in this great struggle, both in the supply of men and of foodstuffs. Canada has probably done most in this respect. At the beginning of the war a Dominion-wide "Patriotism and Production" campaign was started and carried out by the Department of Agriculture. In 1916 the same department started a "Production and Thrift" campaign. The work of this campaign was to spread broadcast a series of five large display advertisements, each making a separate appeal. All the newspapers took the matter up. Government agricultural experts adopted the above motto and mentioned it at all their Institute meetings. Clergymen preached it in the pulpit and teachers in the class room founded lectures thereon. Women's institutes and Home Economic Societies warmly espoused the cause. In fact every class of the community appeared to feel that "Production and Thrift" embodied something in which all were vitally interested. The Department of Agriculture issued a 250-page bulletin entitled "Production and Thrift" in which the move is explained and the resources of each province in the Dominion are discussed and methods suggested for increasing the production. Canada in addition has the natural geographic advantage of being nearest in distance to the mother country, thus affording better transportation facilities than any of the other colonies.

Australia is also doing her share in supplying or helping to supply the meat and wool demand.

In Russia the food problem is still of another kind. It is not shortage of food, like that of Germany, or high cost, as in England, but it is lack of organization. Russia is the largest wheat producing country in the world. It has 288,000,000 acres of excellent wheat land. "Even at her present standard of production, which is less than half that of Western Europe, Russia alone could produce more wheat than is raised on the entire globe to-day." At present the Russian crop is only about ten bushels per acre, yet her lands are as fertile and her climate as well suited for the growing of wheat as those of England and Germany.

Stragetic Moves of the War

(*Concluded from page 390*)

—250 miles distant to the southwest. Angora is 200 miles west of the Turkish front and 350 miles from the Russian lines at or near Erzingan. A fourth route to Constantinople and one likely to be followed in connection with the preceding one is from Trebizond and along the coast of the Black Sea via Samsoun, Sinope, Ineboli, Eregli, to the Bosporus. As the Russian fleet practically commands the Black Sea, all their troops moving along or near this route can be readily supplied by water.

A strategical review of the situation in the east would indicate that every effort will be made by the British-Russian forces to reach Aleppo, Alexandretta, and Adana. Here, in connection with the Russian troops from the north the Turkish line will be broken and the Turks forced to the west of the Taurus Mountains—perhaps routed as in Palestine and in Mesopotamia, thus rendering an advance from the east practicable and easy. Distances to be traversed would, however, be enormous; but transport can be over such long lines and relatively with such facility that nothing seems impossible at the present day in any army's movements.

Field Marshall Hindenburg has said that the war would be settled in the east and that may be true, but in a manner entirely unexpected by him. Turkey is rapidly breaking down, Bulgaria likewise, and Germany is too hard pressed on her own lines to render much aid to Allies so far away.

Melting Copper in Iron Ladles

AS is well known, the fusing point of copper—and for that matter, of numerous other metals such as brass, bronze, etc.—is so high that the use of crucibles of wrought iron or wrought steel in the melting of this metal has been impracticable. When heated to a point at which copper will melt, both these substances are apt to give down under the weight of the copper. Hence it has been necessary to melt such metals in expensive graphite crucibles and with an elaborate heating plant.

A worker in an Alabama plant has recently discovered and patented what promises to be a useful substitute for this expensive method. He first melts down a small quantity of sodium chlorate—common salt—and spreads this molten solution over the inner surface of an ordinary iron or steel ladle. In the ladle as thus treated, and while the salt is still in molten condition, he introduces the copper for melting. He states that the proportion of salt necessary for good results is about one tablespoonful to four pounds of copper, and that using it in this proportion he has melted copper in an open ladle over a blacksmith's forge in from three to five minutes, as against one to two hours required by the ordinary practice.

The inventor also calls attention to the value of the melted salt treatment as increasing the life of blast furnace picking rods. Such bars, after coating with the melted salt, have their durability so increased that an immersion in molten iron of sufficient length to melt an untreated bar completely away will reduce the bulk of the treated bar by one-third only.

"My Employees Are My Most Valuable Asset—"

"Let me explain how we must protect them."

President. "I am going to adopt a plan of life insurance for my employees, and I want to have your opinion."

Foreman. "That's fine, but insurance costs the men money, doesn't it?"

President. "No. I have in mind Group Life Insurance and the firm expects to pay the premiums. It will cost us about 1% of the pay roll."

Foreman. "What about the doctor's examinations? Some might not pass."

President. "Except in a few states where the law requires it, there are no examinations, because factory groups under sanitary conditions, have good health."

Foreman. "That sounds mighty good to me, but what happens if a man is permanently disabled and has to stop working? Does he get anything?"

President. "Yes, his insurance is paid to him in instalments and no more premiums are paid by the firm."

Foreman. "Bully. This plan will appeal to the men. They will realize your interest in them more than ever. You will have their services and good will for life."

President. "I realize that my employees are my most valuable asset."

Group Life Insurance

Promotes a better understanding between employer and employees. It is endorsed by every concern using it. Why not ask some of them. Communications on this subject are solicited.

Write for Booklet. Dept. 121

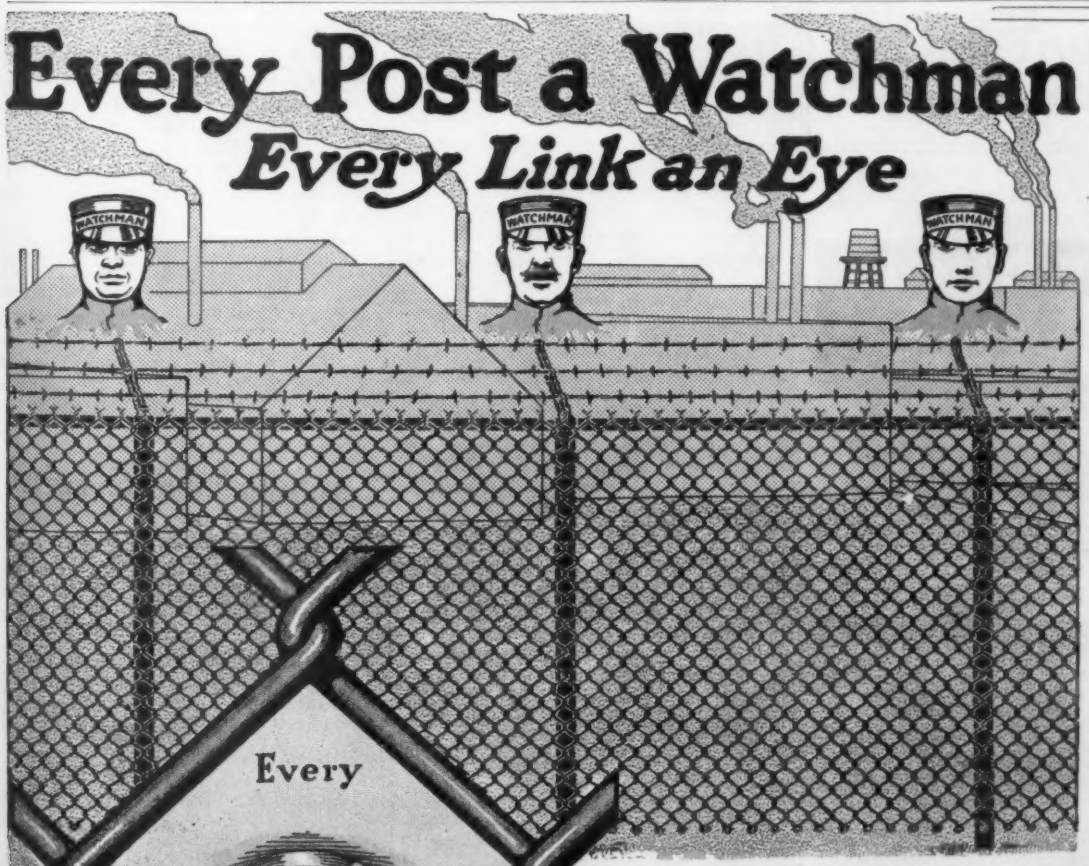
Founded by JOHN F. DRYDEN — THE PRUDENTIAL HAS THE STRENGTH OF GIBRALTAR — Pioneer of Industrial Insurance in America

The Prudential Insurance Company of America

Incorporated under the laws of the State of New Jersey

Forrest F. Dryden, Pres. **Home Office, Newark, N. J.**

Every Post a Watchman
Every Link an Eye



We build Cyclone Fence in all practical heights, with swinging or sliding gates for alleys, switch tracks, driveways, etc.

Our engineers will consult with you to devise a system of protection that will meet your particular needs. Construction superintendent furnished at nominal cost. Illustrated catalog showing various designs sent on request.

CYCLONE
Property Protection
Fencing Pays

It surrounds your factory property with a cordon of sturdy watchmen, ever vigilant, and with a million eyes that never close.

ONE WATCHMAN TAKES THE PLACE OF TWENTY

THE NASH MOTORS COMPANY
KENOSHA, WISCONSIN

Cyclone Fence Company, January 27, 1917.
Gentlemen:—

"Prior to the building of Cyclone Fence around our factory we were employing twenty watchmen, while, since the fence has been built, we have been able to reduce the number to one. We also wish to advise you of our entire satisfaction with the manner in which you executed the contract for the erection of the fence."

Yours very truly,
THE NASH MOTORS COMPANY,
(Signed) *John Bjorn*, Sup't.

The foregoing letter from the Nash Motors Company confirms Cyclone Fence economy. If paid $2.50 per day, the dispensing with nineteen watchmen means a saving of $17,337.50 annually.

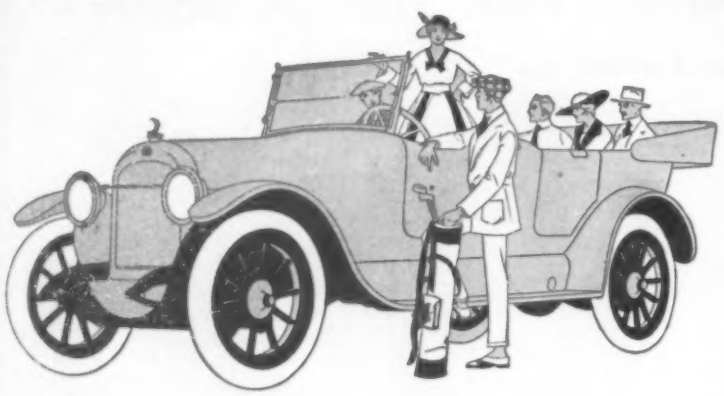
Cyclone Property Protection Fencing

is the recognized "last word" in factory security, adopted by many factory owners with uniform satisfaction.

Cyclone Fence forms a continuous chain link, woven steel barrier around your property—non-climbable, shock resisting, enduring. Fabric of best quality steel wire specially drawn for the manufacture of this fence, heavily galvanized. Posts of heavy tubular steel—have equal resisting power on all sides against shock or strain, or the action of weather.

CYCLONE FENCE COMPANY

WAUKEGAN **Dept. 144** **ILLINOIS**



It is the discriminating person in every community who appreciates the niceties of Moon workmanship.

Moon car bodies are exceptionally fine examples of the coach-maker's skill—while the chassis represents the highest achievements in the field of automobile engineering.

Graceful in outline—the Moon touring car is of stout and dependable build.

MOON CARS

A few Moon Features

Red Seal Continental motor—Delco starting, lighting and igniting system—motor-driven tire pump—Rayfield carburetors—slanting windshield—complete chassis and body equipment.

The Moon Sixes

Six-43—5-Passenger Touring Car - - - - - - - - - - - - $1395
Six-45—4-Passenger *Club* Roadster - - - - - - - - - - - $1485
Six-66—7-Passenger Touring Car—4-Passenger *Club* Roadster—$1750

MOON MOTOR CAR CO. ST. LOUIS, U. S. A.

Prices subject to advance without notice.

Just Published!

WIRELESS TELEGRAPHY and TELEPHONY

Simply Explained

By ALFRED P. MORGAN

Wireless Expert

Price, $1.00 postpaid

170 Pages 156 Illustrations Cloth Bound

The simplest, latest and most comprehensive popular work published on wireless, for the wireless operator, amateur or professional.

THIS is a comprehensive treatise and a close study of its pages will enable one to master all the details of the wireless transmission of messages. The author has filled a long-felt want and has succeeded in furnishing a lucid, comprehensible explanation in simple language of the theory and practice of wireless telegraphy and telephony.

The book treats the subject from an entirely new standpoint. Several very novel and original ideas have been carried out in its making. It is well illustrated by over one hundred and fifty interesting photographs and drawings. All diagrams have been made in perspective showing the instruments as they actually appear in practice. The drawings are carefully keyed and labeled. Many of the photographs are accompanied by phantom drawings which reveal the name and purpose of each part.

This is a book the wireless experimenter cannot afford to be without. It enables one to design and construct their own apparatus. This book will also prove of value to the layman.

MUNN & CO., Inc., Publishers

233 Broadway New York, N. Y.

REDUCE FUEL COSTS ONE-HALF

For Fords and All Other Cars

Start easy in coldest weather!
More power and one-half more mileage!

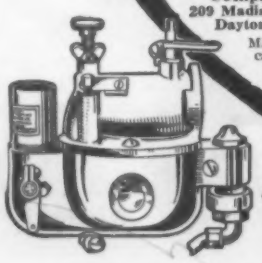
Air Friction Carburetors use cheapest grade gasoline or even half gasoline and half coal oil with excellent results.
250,000 enthusiastic users!
Start your car instantly and move off at once, while motor is cold (even zero weather) with no "spitting," "popping," or "missing." In other words, end your carburetor troubles.

AIR-FRICTION CARBURETORS

Newly perfected model for 1917
If your dealer cannot supply you, write or wire us at once, sending his name and the name and model of your car.
30 per cent off list price where no representative is already appointed.
Dealers, garages, and repair shops make greater profits and give more satisfaction supplying AIR FRICTION CARBURETORS, and spark plugs, than on any other accessory they can handle.

The Air Friction Carburetor Company
209 Madison Street
Dayton, Ohio

Manufacturers of carburetors for pleasure cars, trucks, tractors, and motor boats.



Show this ads. to your dealer or repair shop.

What Shall We Do to Prevent Our Enormous Forest-Fire Losses

(Concluded from page 405)

these losses cannot be estimated. If a city burns, said Prof. Hosmer, it can be rebuilt from the insurance; when a forest burns everyone in any way dependent on it is left empty-handed.

Forest fires destroy not only the mature standing timber but also the small trees that were to make the forest of the future, thus robbing the human generations to come. Further, the forest fires by destroying the ground cover the humus under the trees, often lay bare the soil and lead to erosion or soil washing, particularly on mountain sides. Without the protection of the forest at their sources the streams become irregular in flow and a long train of ill effects is set in motion that is far-reaching in its results.

The remedy lies first and foremost in education, says Prof. Hosmer, for forest fires can be controlled. The keynotes are prevention and control: First to check the causes; and second, to quickly control any fires that start. Only a few years ago forest fires were looked upon as an unpreventable calamity, but the past decade, he says, has shown that the problem is one that can be solved. To free our forests from fire requires that back of all laws and regulations and organized measures of control, there must be an intelligent and alert public opinion. In a very real sense the forests belong to all the people, concluded Prof. Hosmer, and it should be the duty of every citizen of the state who goes into the forest, either for profit or pleasure, to use the same care with fire that he would use at home, and in other ways lend his coöperation until the time shall come when forest fires shall cease to be a menace.

The Importance of Trademarks in Our Latin-American Trade

By Don Decatur

NO matter how astounding a new invention may be, no matter what the quality of a new commodity, the average Latin-American business man is more interested in the trade-mark stamped upon it than the actual performance or service it represents.

In preparation for the tremendous commercial struggle which will follow this war, the American exporter may well study the peculiar foibles of those countries where rivalry will be most keen. What is true of one Latin-American country is true of all, and it is certain that the primary assault of trade will be made in the West Indies and South America.

The United States has recently taken over direct control of the governmental functions of the Republic of Haiti, second only in size and importance to Cuba, and it is here, if we grasp the opportunity immediately, that American business interests may entrench themselves in a favorable outpost on the direct route to South America.

On a recent visit to Haiti, the writer was impressed with its great and undeveloped natural resources, and the opportunity it offers for immediate development by the United States. A few American business men who had failed in Haiti prior to the American occupation, had failed because they did not understand, or would not consider, the notions of customers regarding trade-marks. In no country is the trade-mark of more importance than in Haiti. The suspicion of unmarked and unadvertised goods is a natural relic of European influence.

One American firm stood out as a bright exception to the usual story of failure. This firm manufactured ordinary wheat flour. On introducing their brand of flour into Haiti some years ago, a brilliantly colored trade-mark has been designed which represented a barn-yard fowl. No choice could have been more happy. The Haitian peasant, unable either to read or to write, recognized this bird. The picture connected the flour with something he understood. Therefore, when he wanted the flour, he had merely to name the fowl.

The next step in introducing this brand, was a country-wide distribution of samples in gay-colored trade-marked sacks. The distributing agents spread the word far and near that this new flour topped all records in the world for amount of bread produced, by weight of flour, and that the bread it made was lighter and easier-rising than any other.

It was only a question of a few months when thousands of country people, doing their weekly marketing in the coast towns, had seen the barn-yard fowl brand of flour, were commenting on the "gentility" of the manufacturers in distributing free samples, and were asking to buy the brand.

A great cry for barn-yard fowl brand of flour went up from the warehouse-men in the coast towns, so great that the manufacturers rubbed their eyes to be sure they were awake. They had not dreamed of such a return from such a comparatively small market. They began to study the situation and found that nearly half of the money spent on food in Haiti was spent for flour.

Orders poured in faster than they could be filled. A milling company which had been dormant for years found itself overwhelmed with an export business of great magnitude. Flours which had been standard in the United States for years, were scorned in Haiti in favor of the barn-yard fowl. Retail prices soared. In some cases lucky retailers, who had bought barnyard brand at $9 a barrel, were able to retail it in 12-pound sacks for $24 a barrel, while standard brands went begging at ordinary prices.

Since the outbreak of the European War, shipping conditions have been so poor between the United States and Haiti, that the demand for this special flour has been satisfied only by the use of sailing ships plying from Mobile. Distribution, after the flour has reached the port-of-entry in Haiti, has also proved difficult and, in isolated ports of the island, has sent the price soaring.

While in Haiti, I became acquainted with a struggling Haitian merchant who had lost his capital in former speculations and I introduced to him the marvelous results of advertising trade-marked goods. This merchant's sole asset was a small warehouse in a back street, some distance from the main business thoroughfares, where the country peasants rarely made their way to trade. As it stood, the property had little sale value. The merchant's family lived above the store.

I suggested that he employ all his credit in stocking the barn-yard fowl flour against that day when, due to the shortages constantly recurring in shipments, the retail market price would be high. The next step was to advertise. This is ordinarily a difficult proposition in Haiti, where the masses cannot read or write. I impressed him with the fact that only an article in exceptional demand would bring the people to his out-of-the-way store.

The procedure followed was quite the most elementary form of advertising. Twenty pieces of sheet-tin were cut to the outlines of the well-known barn-yard fowl, as it appeared on the trade-marked flour sacks. These were painted by a local artist at a cost of 15 cents each.

For a pittance, space rights were bought on houses and posts along the three main roads entering the city. The tin signs were then tacked up. Underneath each was painted a guiding hand, pointing a directing finger. The signs followed up into the city and stopped at the alley entrance to the obscure street on which my friend's store was located. Then the guiding finger pointed up the alley. In front of the store we had placed a ten-foot signboard with a striking enlargement of the flour trade-mark.

It was not long before the delighted natives discovered the solution of the mystery of the signs. Their acuteness in this discovery pleased them so much that they of course, bought their flour in this store.

The Haitian merchant has since written me a thank-you letter, incidentally stating that he has made $5,000 in the famous flour, and complimenting me on the introduction of advertising into Haiti.

Accelerating America

What a wonderful stimulus to our nation the motor vehicle has proved! In city and country, in business and pleasure, it has enlarged our opportunities and quickened our very lives.

This contribution to our spirit of progress has been largely made possible by the Continental Motor. For more than 250 models of automobiles and motor trucks, this world-famous motor in its various models provides the power plant. Because of its firmly established reputation with hundreds of thousands of owners, the Continental Motor everywhere inspires confidence in prospective buyers. It truly accelerates the motor vehicle industry, and thus furthers our nation's progress.

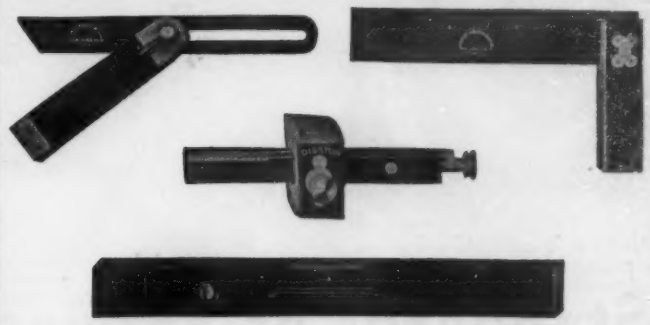
CONTINENTAL MOTORS CORPORATION

OFFICES: Detroit, Michigan
FACTORIES: Detroit-Muskegon

Largest exclusive motor manufacturers in the world

Continental Motors

DISSTON
SAWS AND TOOLS



Apply Disston Standards to Your Own Work

A try square, level, gauge or bevel is of value to its user only in proportion to its accuracy. Approximate accuracy is not enough. It must be as nearly perfect as human ingenuity can make it.

A building erected by other than the most accurate methods would be unsafe. A piece of furniture made by other than the most accurate cabinet work would be practically worthless.

The name Disston on a measuring tool, level or bevel, is an assurance of accuracy, as the same name on a saw or trowel or screw-driver or other tool is an assurance of the highest quality attainable.

Whether you are a mechanic whose livelihood depends on the quality of the work you do, or an amateur tool-user who takes pride in doing a workmanlike job, you owe it to yourself to lay out and test your work by instruments of Disston accuracy.

Ask for our free "Hand-Saw Booklet"

HENRY DISSTON & SONS, Inc. - PHILADELPHIA, U. S. A.
Canadian Works: Toronto, Canada

DISSTON

Spark Plugs are not often considered in connection with the efficiency and performance of the motor. Dynamometer and actual road tests *prove* them to be a most important factor.

Bethlehem Five Point Spark Plugs under such tests, have shown that they are the ultimate in both theory and practice. They *must* give you satisfaction far in excess of that to which you have been accustomed.

Guaranteed for the Life of Your Car

Price One Dollar (in Canada $1.25)

If your dealer cannot supply you, write us, specifying make and model of car

THE SILVEX COMPANY
BETHLEHEM PRODUCTS
SOUTH BETHLEHEM, PA.
E. H. SCHWAB, President

BETHLEHEM

Set this Truscon steel Building *in any* Vacant Space

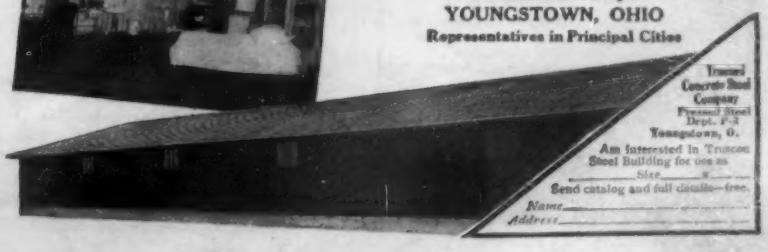
If you need a new building immediately—Truscon Steel Buildings will answer every purpose. Suitable for machine shops, warehouses, offices, schools, hospitals, railroad sheds—in fact, for almost any use. These buildings are *solid, all-steel, permanent* constructions—*weather-tight* and *fireproof—perfectly daylighted* and *well ventilated.* In addition, these rapidly erected buildings have the special advantage of portability—being easily taken down and re-erected in a new location with no loss or depreciation.

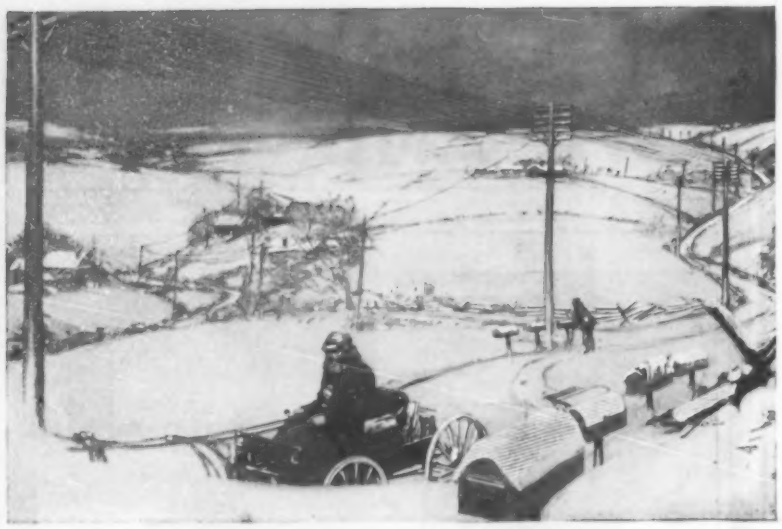
Truscon STEEL BUILDINGS

—Consist of interchangeable steel panels, including steel sash, steel doors and steel-tile roof. These are easily assembled by a simple slot and key device. A complete building, ready for occupancy, can be built in a surprisingly short time. Very easily enlarged—their standardized design makes additions as easily completed as the original building itself.

Truscon Steel Buildings are being used by large industrial companies in all sizes—widths up to 40 feet and lengths up to 500 feet. No matter what sized building you require write us or fill in the coupon below.

TRUSSED CONCRETE STEEL CO.
Pressed Steel Dept.
YOUNGSTOWN, OHIO
Representatives in Principal Cities





Standards of Service

In rural communities clusters of mail delivery boxes at the crossroads evidence Uncle Sam's postal service. Here the neighbors trudge from their homes—perhaps a few yards, perhaps a quarter mile or so—for their mail.

Comprehensive as is the government postal system, still the service rendered by its mail carriers is necessarily restricted, as the country dweller knows.

Long before rural delivery was established the Bell System began to link up the farmhouse with the neighboring towns and villages. One-fourth of the 10,000,000 telephones in the Bell System are rural. They reach more places than there are post offices. Along the highways and private lanes the telephone poles lead straight up to the farmer's door.

He need not stir from the cheerful hearth ablaze in winter, nor grope along dark roads at night for friendly news or aid in time of trouble. Right in the heart of his home is his telephone. It is the American farmer's key to the outside world, and in no other country is it found.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy *One System* *Universal Service*

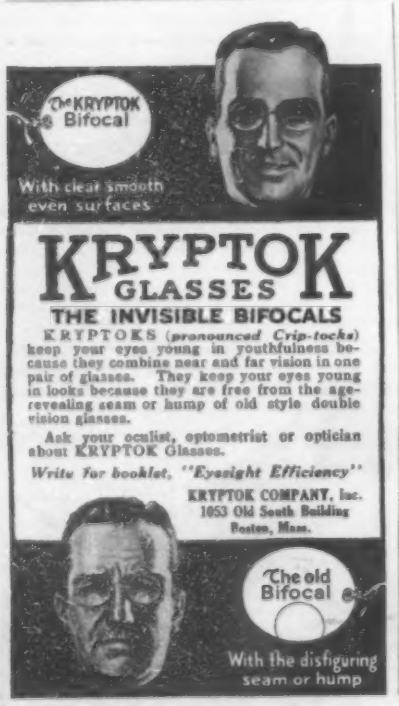
The Design and Construction of Induction Coils

By A. FREDERICK COLLINS

6¼x9¼ inches. Cloth. 272 pages. 159 illustrations. $3.00

This work gives in minute details full practical directions for making eight different sizes of coils varying from a small one giving a ½-inch spark to a large one giving 12-inch sparks. The dimensions of each and every part are given and the descriptions are written in language easily comprehended.

MUNN & COMPANY, Inc., Publishers, Woolworth Building, NEW YORK CITY


The KRYPTOK Bifocal
With clear smooth even surfaces
KRYPTOK GLASSES
THE INVISIBLE BIFOCALS
KRYPTOKS (pronounced Crip-tocks) keep your eyes young in youthfulness because they combine near and far vision in one pair of glasses. They keep your eyes young in looks because they are free from the age-revealing seam or hump of old style double vision glasses.
Ask your oculist, optometrist or optician about KRYPTOK Glasses.
Write for booklet, "Eyesight Efficiency"
KRYPTOK COMPANY, Inc.
1053 Old South Building
Boston, Mass.
The old Bifocal
With the disfiguring seam or hump

Real Help for Tired Feet

A busy day and on your feet most of the time—a long, tiresome trip or a hike in the country—new shoes to break in—all these mean tired feet. Soothe and rest them by applying a few drops of

Absorbine Jr.
THE ANTISEPTIC LINIMENT

Or, if you are very tired and your feet burn, ache or swell, soak them in a solution of Absorbine, Jr., and water. Relief will be prompt and lasting.

You will like the "feel" of this clean, fragrant and antiseptic liniment. It penetrates quickly, leaves no greasy residue and is intensely refreshing. Only a few drops needed to do the work, as Absorbine, Jr., is highly concentrated.

Keep a bottle handy at home, at the office, or in your grip when travelling.

$1.00 a bottle at most druggists or postpaid.

Send 10c for Liberal Trial Bottle or procure a regular size bottle from your druggist today.

W. F. YOUNG, P. D. F.
361 Temple St. Springfield, Mass.

American Sources of Nitrogen

(*Concluded from page 394*)

production of the ammonia is still variable, dependent upon the returns from three other products, but with less freedom in fixing a minimum figure.

(c) The same holds good for ammonia obtained by the Mond process, in which the products are power gas, tar and ammonia. There is here, naturally, still less freedom in establishing a minimum cost of production for the ammonia. The process has been installed with excellent economic results in England and Germany. It should be introduced widely in the United States, in order to utilize the mountains of refuse coal accumulating about our collieries.

(d) The above applies equally to the closely allied production of power gas, tar and ammonia, by the Mond process, from peat. This is done on a large scale in Germany, on a smaller scale in Italy and England. The results are most satisfactory.

(e) The manufacture of ammonia from organic waste, notably from beet-root residues, the wash-water from scouring wool, fecal matter, etc., has not been attempted in this country. The cost of production would be determined by the current rate in the fertilizer market for the nitrogenous matter employed, plus the cost of operation.

(f) The cost of production of ammonia obtained from cyanamid is susceptible of a more accurate statement. Cyanamid, made at Niagara Falls, Ontario, and consumed in this country to the extent of over 33,000 short tons annually, was imported in 1915 on a valuation of $48.04 per short ton. The cost of production of the cyanamid, based upon an annual rate for electricity of $12.00 per H. P. Y. (horse-power-year) is $28.74. The production of one short ton of anhydrous ammonia requires the use of 4.12 tons of 20 per cent cyanamid (value $118.41). The cost of manufacture per ton, in addition, is $30.80. The total cost of production of one ton of ammonia, made by this method, is, therefore, $149.21.

(g) The manufacture of synthetic ammonia, by Haber's method, from nitrogen and hydrogen, has not been attempted outside of Germany. The cost of production was discussed very fully by me in 1912 ("Utilization of Atmospheric Nitrogen," pp. 32-39; see below). Since then the cost of hydrogen and nitrogen, prepared upon a large scale, has been very materially lowered, both here and abroad.

Prior to the war, nitrogen, in the form of ammonium sulphate, commanded 12 cents per pound of pure nitrogen. The nitrogen necessary for making 1 pound of ammonia cost then 0.45 cents; the hydrogen cost 2.11 cents, a total cost of 2.56 cents. Current costs are now much below 2 cents per pound, for the two gases required. The cost of operating a plant for the synthetic production of ammonia is exceedingly low. It is probable that the total cost of producing synthetic ammonia would not exceed 3 cents per pound, as compared with 7 cents by the cyanamid method.

In other words, the Haber method should decrease the cost of production, per short ton of anhydrous ammonia, from $142.21 to $63.93, and possibly much lower.

The method involves close technical supervision of a high grade. The patents have still a few years to run.

3. Nitric Acid.—

(a) Prior to the war nitric acid, 42° Bé., (=67.5 per cent HNO_3), made from Chile saltpeter, sold in New York at $97.50 per short ton. This is equivalent to $144.50 per ton of pure acid (100 per cent HNO_3). At the same time nitric acid, 42°, was quoted at $65.13 in Hamburg. It may be assumed that the German price approximated very closely to the actual cost of production, under favorable conditions, on a large scale. It is almost exactly ⅔ of the New York quotation. On the basis, of the German cost of production from Chile saltpeter, one short ton of pure nitric acid (100 per cent HNO_3) would cost $96.32.

(b) The cost of nitric acid produced by the electric arc is chiefly dependent upon the cost of electric power.

The results obtained in the Norwegian works, if based upon the cost of electric power at Niagara Falls (on the Canadian side) of $12.00 per H. P. Y., show a cost of production per short ton of pure acid (100 per cent HNO_3) of $56.17.

If the cost per H. P. Y., of $7.50 (available in fairly large quantities in the western section of the United States) be adopted, the cost per ton of nitric acid sinks to $45.14, when made by the Norwegian or Birkeland-Eyde process.

The new American Rankin arc process gives apparently a yield about 33 per cent greater than the Norwegian process, per unit of electric power. Assuming this to be regularly obtainable on the large scale, the price per ton, when using the American process, would fall still further to $41.47.

(c) The costs of oxidizing ammonia to nitric acid, by the Ostwald catalytic process, are not publicly known. Confidential information, based upon statements from the manager of the works in Belgium, where the process was in use, prior to the war, gives the cost of oxidation, etc., as $10.74 per short ton of pure nitric acid (100 per cent HNO_3). This includes the cost of liberating ammonia from cyanamid and the cost of concentrating 52 per cent nitric acid to 100 per cent acid (=$3.80).

On this basis, the manufacture of pure nitric acid from ammonia, obtained from cyanamid, supposing the latter to be made by the aid of electric power costing $12.00 per H. P. Y., would involve a cost of production, per short ton, of $63.68.

If the electric power required in the manufacture of cyanamid costs but $7.50 per H. P. Y., the cost per ton of nitric acid sinks to $57.13.

In general, it may be stated that with anhydrous ammonia costing $150.00 per ton, nitric acid (100 per cent HNO_3) costs about $63.70 per ton.

If ammonia costs $100.00 per ton, the cost of producing pure nitric acid falls to $46.05 per ton, etc. If ammonia costs $64.00 per ton, (the estimated cost by the Haber process), nitric acid would cost $33.04.

The cost of production of nitric acid, based upon known factors, may then be summed up as follows:

PURE NITRIC ACID (100 PER CENT HNO_3). COST PER SHORT TON:

From Chile saltpeter, at current rates in 1914	$96.32
By fixation of atmospheric nitrogen, Birkeland-Eyde arc process (1 H. P. Y. = $12.00)	56.17
By same process (1 H. P. Y. = $7.50)	45.14
By American arc process (1 H. P. Y. = $7.50)	41.77
By oxidation of ammonia, ammonia costing $150 per ton, obtained from cyanamid (1 H. P. Y. = $12.00)	63.68
The same (1 H. P. Y. = $7.50)	57.13
The same, ammonia costing $100 per ton	46.05
The same, ammonia costing $64.00 per ton, by Haber's process	33.04

For further details in regard to production costs, the work "Utilization of Atmospheric Nitrogen" (Special Agents Series No 52, Bureau of Foreign and Domestic Commerce) may be consulted.

The Field for Governmental Investigation

In connection with the recently enacted legislation for establishing the manufacture of nitric acid required in the production of explosives, provision is made for careful preliminary investigation. It would seem desirable to have this preliminary work as exhaustive and final in its character as possible; solving not only the problem for the Department of War, as regards complete independence from foreign sources for its supply of combined nitrogen, normally, or in periods of emergency, but also blazing the trail for private initiative to follow, in rendering American industry and agriculture equally independent of outside sources.

A primary question to settle is whether we are in any way necessarily dependent upon hydroelectric power, in creating an industry which will fully supply the nation's requirements for (a) combined nitrogen in agriculture, and (b) nitric acid in industry and in the manufacture of war munitions. It should be authoritatively established whether there is an economic

future for the exploitation on a grand scale of the now wasted or neglected raw material, in the form of coal refuse, lignite or peat for meeting the first or both of the requirements.

In our country geographical location, cost of transportation, etc., enter into the problem to an extent unknown in European lands, with the exception of Russia. From personal experience in studying European plants for solving the nitrogen problem, the initial steps of investigation might advantageously be outlined as follows:

1. With an industrial unit of 5,000 H. P., the effective value of the new Rankin process of fixing atmospheric nitrogen, in the form of nitric acid, should be definitely settled. An independent plant might be erected, or use could be made of the 5,000 H. P. unit, now ready for operation near San Francicso. In connection with this there should be a careful study of available sites of cheap water-power. The lowest that I have thus far been able to locate is one of 150,000 H. P., capable of yielding power at the rate of $6.00 per annual horse-power. Comparison may be made with costs abroad: $2.00 in Iceland; $2.00 to $5.00 in Norway; $12.00 at Niagara Falls, Canadian side; $20.00 at Niagara Falls, American side.

2. An adequate unit should be constructed and operated to determine the maximum yield of nitric acid, and the maximum cost of production, in connection with the oxidation of ammonia by the Ostwald catalytic method. I am informed that the yield in the Belgian works ranged above 90 per cent of the theoretical. The process is covered by an American patent, but it is extremely doubtful that this patent is valid. A German patent was refused to the inventor on the ground that all the essential facts were known before.

3. A small but adequate plant should be constructed to determine the maximum cost of producing ammonia synthetically, by Haber's method, from nitrogen and hydrogen. The cost in this country of both gases is now fairly well established, and this systematic, economical mode of production can be easily standardized.

4. A plant of some size should be put up in one of our coal centers for the generation, on a large scale, by the Mond process, of power gas, ammonia and tar. The size of this plant should be sufficient to yield enough gas to generate at least 5,000 H. P. In such a plant, it will be easy to determine the exact cost of producing ammonia from coal waste or cheap coal. The accompanying two products, gas and tar, possess market values not liable to material fluctuations under normal conditions. Geographical location affects, to some degree, the results as based upon local consumption of power gas, or the transmission of electric current, generated by such gas, within certain limits. The fundamental facts, applicable to general classes of coal, can be readily determined. The specific utilization of these facts, bearing upon any given grade of coal, and the available market for power or electricity, for any coal center, are matters of mathematical calculation.

5. A central station should be located at a large plant distilling western lignites—such as the works at Denver, treating 500 tons daily—in order to ascertain, as closely as possible, the minimum cost of producing ammonia from this source.

6. An experimental plant should be located in a suitable peat region for the determination on an adequate scale of all factors connected with the production of power, ammonia and tar from our enormous peat deposits.

The six fields of investigation, as outlined above, appear to me to fall logically within the purview of the preliminary studies, authorized by recent enactment. Their results would solve, as far as the United States is concerned, all problems connected with assuring an adequate supply of combined nitrogen, produced within the nation's borders from the atmosphere, or from domestic raw material. A decision as to the most effective and economical process can be reached only when such data have been gathered.

It is not impossible that geographical conditions may dictate the use of more than one process. It is conceivable that nitric acid might be manufactured more advantageously by the arc process in the northwest, while on the Atlantic seaboard the transformation of ammonia into nitric acid might be distinctly cheaper. Again, in a remote section, where coal is abundant, it might prove desirable to secure ammonia directly by the Mond process, employ the accompanying power gas for the fixation of atmospheric nitrogen by the arc process, and then ship the total product, with great economy in cost of transportation, as ammonium nitrate, to suitable markets.

In case careful and exhaustive experimentation shows conclusively that a supply of nitric acid can be secured, under normal conditions, most economically by the arc process, and a large plant should be erected for this purpose, the surplus product, during times of peace, can be supplied to American industries consuming the acid. Incidentally nitrous acid and the nitrites employed very largely in the manufacture of dyes, and in dyeing operations, are obtained most economically by this method. Norwegian synthetic works furnish the entire supply of nitrites for Germany and the rest of Europe. Should it prove that the oxidation of ammonia provides nitric acid more cheaply than it can be secured otherwise, the intermediate products, cyanamid, ammonia, or ammonium sulfate, can be employed during times of peace as a fertilizer, or, in the case of ammonia, to meet special industrial demands.

I am convinced that when the various phases of the problem have been accurately and conclusively solved under Governmental direction, private initiative will rapidly appropriate the results of official investigation. Ultimately, the main purpose of a Government plant may well be confined to maintaining in effective condition an equipment, capable of vastly increasing at a day's notice, the current output of nitric acid, to meet the nation's needs in case of sudden danger.

The Radio Inspector in the Rôle of Wireless Detective

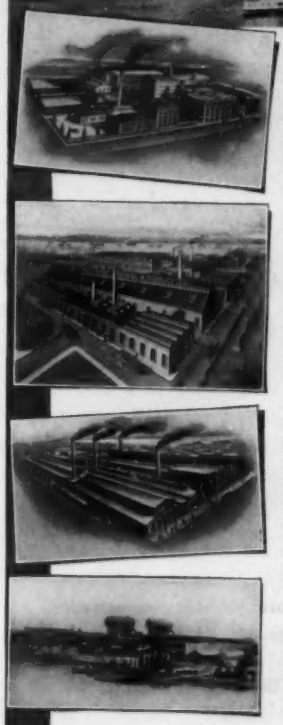
Concluded from page 395

of Chief Krumm was somewhat simplified; still, his was the task of finding the culprit among several thousand wireless amateur stations in New York city and vicinity. To localise his search he soon arrived at the conclusion that the station was either in lower Manhattan or in Brooklyn, and he immediately eliminated the former for the reason that such stations as are in operation in the office buildings of lower Manhattan are in responsible hands.

The chief inspector then mounted a short-range wireless receiving set on a motor truck and started on a long journey through the Brooklyn streets, always "listening in" to catch the now familiar S O S signals. By noting the intensity of the signals the chief was able to gage his relative distance from the sending station on different nights. The work was slow—and almost discouraging; yet by degrees the radio detective got closer and closer to his quarry until finally he fixed the neighborhood definitely. Then followed a week's hunt for the house containing the sending station, during which time the motor truck station traveled up and down the streets waiting for the call that would lead the inspector to the sending instrument. Finally the call came, and the search narrowed down to a block of houses. The following day the inspector went up on the roof of one of the houses and scanned the house tops, with the result that he found an aerial a short distance away.

It was ordinary police work from that point on to find that William F. Eckhoff, a sixteen-year-old grocer's clerk, was the culprit sought. When arraigned young Eckhoff pleaded tearfully that his jokes were not intended as jokes, but were the result of an ignorance that failed to understand the meaning or importance of the signals he had been sending out.

$125,000,000 flowed into Baltimore in 1915 and 16



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Standard Oil Company, 26 Broadway, New York
Baltimore Car and Foundry Company (Standard Steel Car Company), Pittsburgh, Pa.
Texas Oil Company, 17 Battery Place, New York
Atlantic Refining Company, 310 Produce Exchange, New York
Central Foundry Company, 90 West Street, New York
Curtis Bay Chemical Company, 27 William Street, New York
Baltimore Copper Smelting and Refining Co., 120 Broadway, New York.
Raymond Concrete Pile Company, 140 Cedar Street, New York
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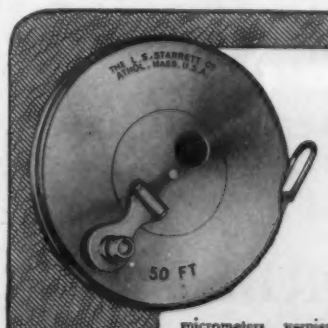

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Apparatus for Balancing High Speed Machinery

ROTATING machinery cannot run properly unless it is perfectly balanced. Even a small amount of unbalancing will give rise to a host of troubles—noise, vibration, excessive power consumption, undue wear of the bearings, etc.—and these effects are especially serious in high speed machinery, such as fans, automobile crankshafts, motor armatures, turbine runners, etc.

But to manufacture an object that is perfectly balanced is all but impossible. No matter how carefully the work is done, some slight variation from perfect symmetry of form or homogeniety of composition will almost always throw the balance out, so that tests and corrections on each finished piece are necessary.

The first step is to roll the body on parallel knife-edges, noting the "heavy" side and drilling a little off here and adding a little weight there until perfect static balance is secured. But this is not sufficient. A body that is in perfect static balance may prove to be woefully out of balance when it revolves. For example, a grindstone that is set a little obliquely, instead of squarely at right angles, to its axis, may balance properly when at rest, but every farm boy knows that such a grindstone will endeavor to tear itself loose from its setting when he starts to turn it.

It is very difficult to secure good running balance. Several methods are in use but they generally involve a process of trial, correction, retrial, further correction, etc., until satisfactory results are obtained. To shorten this operation and to provide exact information as to just where and to what extent corrections must be made to a body in order to bring it into perfect running balance, are the objects of an ingenious machine that has recently been invented by a Philadelphia engineer, Mr. N. W. Akimoff.

Reference to the illustration will make the details of the construction of this machine clear. The piece to be tested, after being balanced statically, is placed in adjustable bearings carried on a heavy lathe bed and is rotated by means of a chain by a motor which is mounted on the underside of the bed. This motor is geared to a device called a "squirrel cage," likewise mounted on the underside of the bed. The instrument belted to the left end of the squirrel cage is a speedometer, while under this is a speed adjusting rheostat for the motor.

Now the unusual feature of this machine is that the bed is not rigidly mounted on its supports, but is attached by a hinge at the right-hand end and rests only on a spring at the left-hand end so the it is free to move. When the motor is started the test piece revolves and, being out of balance, will cause the bed to vibrate more or less vigorously, depending on the speed and the amount of unbalance. The little dial at the right of the speedometer indicates the amplitude of the beam's vibrations. The motor and squirrel cage, being mounted on the beam, vibrate too.

The squirrel cage now comes into the story. It can be proved mathematically, but is also self-evident, that if this squirrel cage, which rotates at the same speed as the test piece, is unbalanced to the same extent as the test piece, but in the opposite direction, its tendency to vibrate the beam will neutralize that of the test piece and the beam will come to rest. The way the squirrel cage is unbalanced is as follows: It consists of a number of tubes supported by four disks. Inside each tube is a rod which can be moved axially by turning a nut carried by the tube. Obviously any displacement of one rod with respect to the rod directly opposite to it will destroy the running balance of the squirrel cage without affecting its static balance.

While the machine is in operation, therefore, the various rods are shifted until the indicator shows that the bed has ceased to vibrate; then the machine is stopped. The weight of the rods and the distance through which they have been moved being known, exact data is proved for correcting the test piece to give it perfect running balance.

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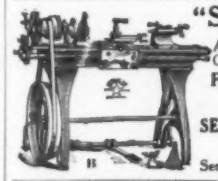

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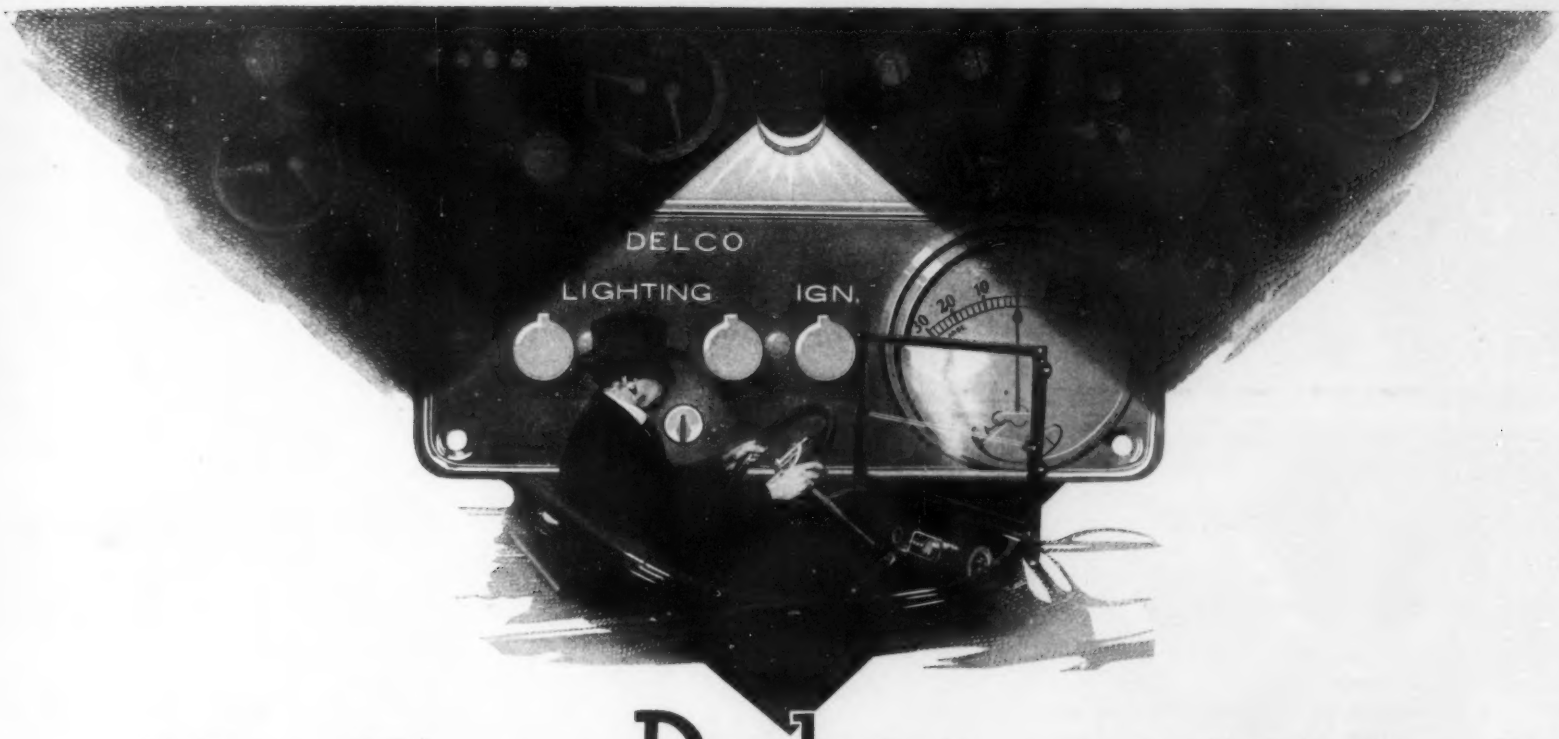

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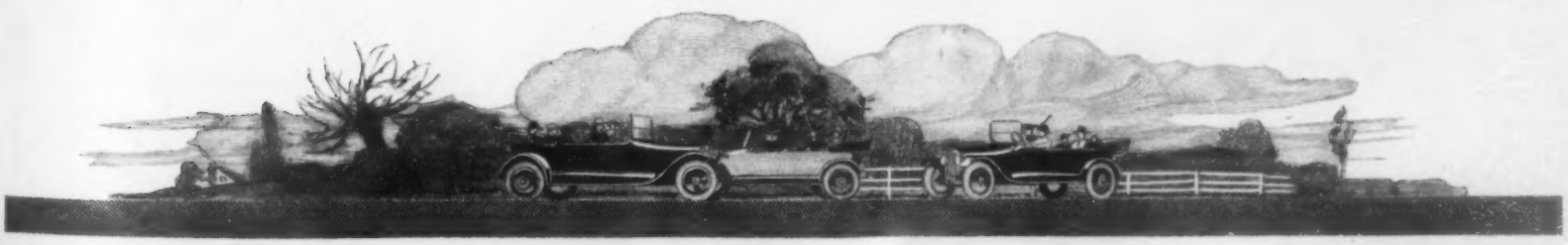

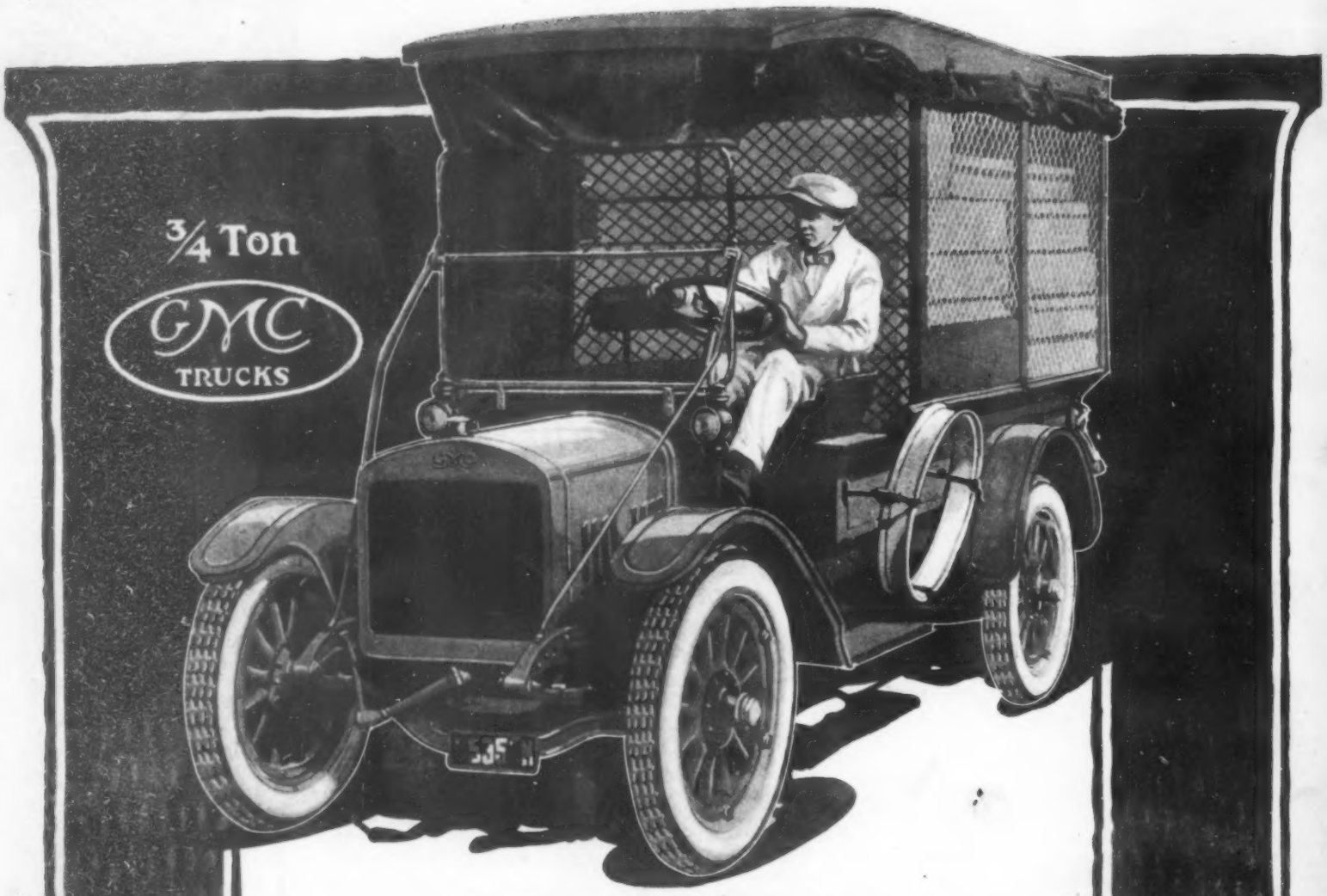

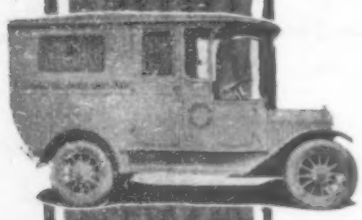

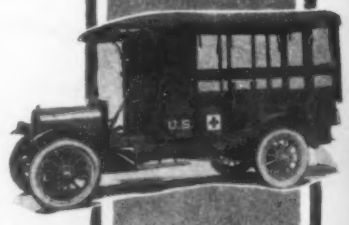

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They are used by transportation companies, furniture and hardware dealers—by florists, market gardeners, dairy farmers and general stores—by railroads—telephone, telegraph and express companies.

The large packing houses of the West own fleets of them and nationally known manufacturers in many lines operate them both at their home plants and in their branch house cities.

They have withstood the wear and tear of traffic over city streets, and have given consistent, dependable service. Records show that they require only reasonable attention and that the operating and upkeep cost has been most reasonable.

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They have shown that they possess the power and endurance to master the poor roads and steep grades, and that they possess those qualities of strength and stability which motor trucks must possess to operate profitably in country service.

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Like all GMC Trucks they are practical, common-sense trucks—not cheap in any sense—not built to meet price competition.

And it's because they are not built to meet price, but to give service, that they have won the reputation in many localities of being the best and most economical, light delivery truck on the market.

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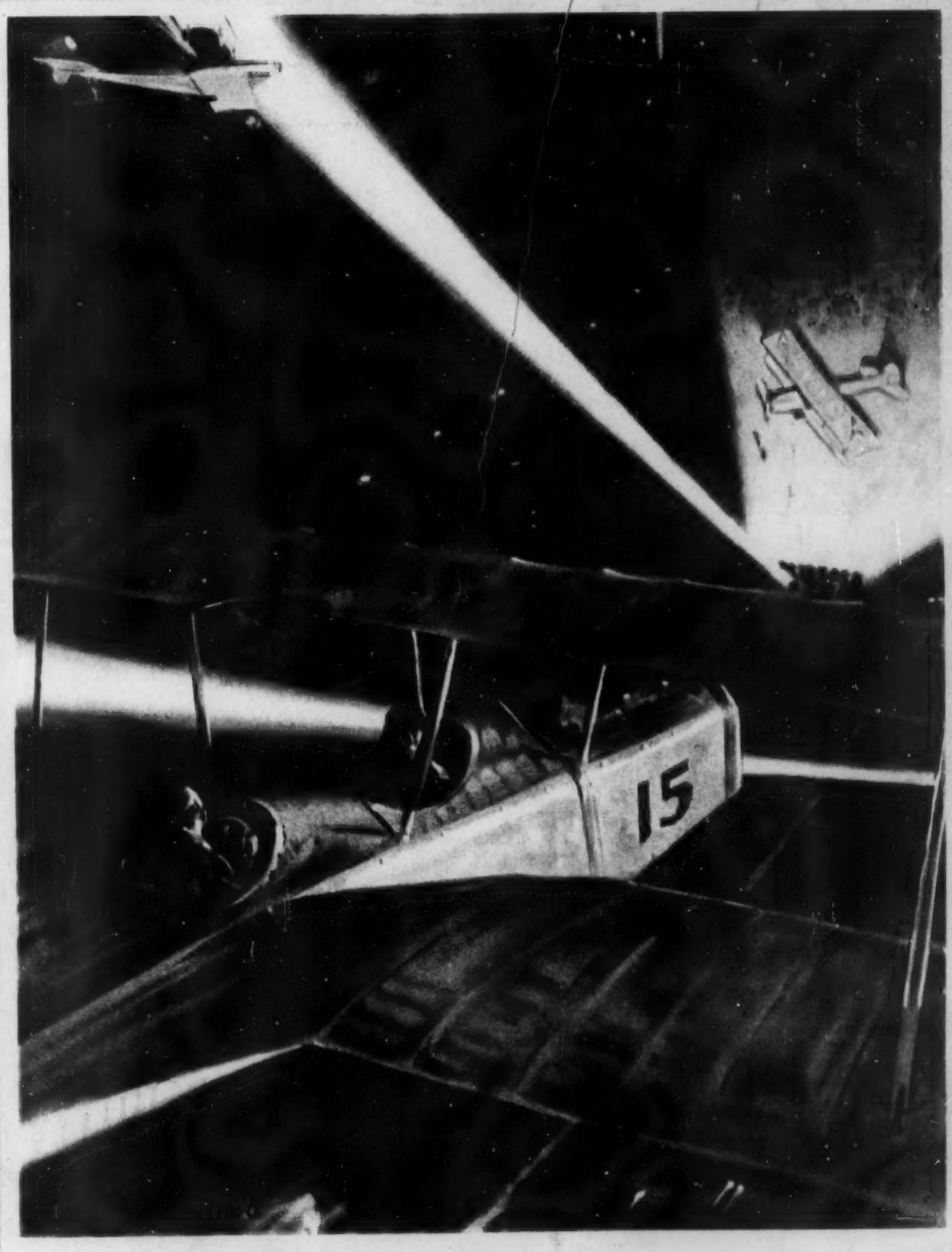

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April 28, 1917

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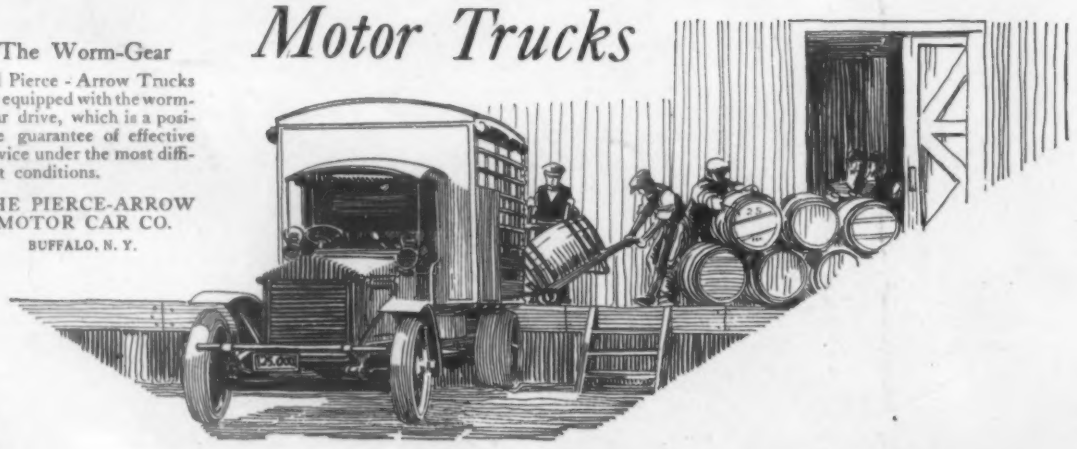
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